Sitronic STS

Operation manual

SIT Automation

Contents

Redefining Motor Control

The original pioneers of soft start technology, Fairford Electronics Limited have been at the forefront of motor control innovation since the 1970's. Fairford have manufactured and supplied over 1 million products into the market place and are recognised as the reference point for many control solution providers worldwide.

In 2009, the need for a new technology that bridged the gap between drive technology and soft start was recognised and the development process began for STS™, a new form of motor control that met the needs of those requiring the functionality of a drive in a fixed speed application. The key aspects of a drive (energy saving and communications) as well as original features of a soft start including internal bypass and lower cost, meant the base design was enhanced even further.

iERS (intelligent Energy Recovery System) is Fairford's patented energy saving system with a combined internal bypass to save energy on lightly loaded motors. iERS reduces the voltage and current supplied to lightly loaded motors to only allow the motor to consume the exact amount of energy required to maintain the speed at that load.

When the motor is at full load the internal bypass closes, this reduces the losses produced by the control element. This combined approach enables iERS to save more energy in more applications than any other competing technology.

iERS has been market proven over the past 10 years and has now reached its latest development realising even greater savings. Applications such as compressors, refrigerators, pump jacks, moulding machines and chillers can typically see savings of around 8-40% of total energy consumption when lightly loaded.

With size and cabinet capacity an ever increasing focus, Fairford developed the world's smallest power to size ratio motor controller. STS™ utilised Fairford's globally renowned Automatic Setup feature to program the unit to each individual application using only a 8 button process. Since then it has removed buttons and uses touch screen technology bringing the user interface to even greater management levels.

With full motor overload protection as well as full data logging, upgradeable software in the field and extensive input/output programmability, STS™ meets all of the key design requirements. 2

iERS
Intelligent Energy Recovery System

Safety

Important information

Installers should read and understand the instructions in this guide prior to installing, operating and maintaining the soft start. The following symbols may appear in this guide or on the soft start to warn of potential hazards or to draw attention to certain information.

Dangerous Voltage

Indicates the presence of a hazardous voltage which could result in personal injury or death.

Tension dangereuse

Indique la présence d'une tension dangereuse qui peut entaîner des blessures ou la mort.

Warning/Caution

Indicates a potential hazard. Any instructions that follow this symbol should be obeyed to avoid possible damage to the equipment, and personal injury or death.

Avertissement/Mise en garde

Indique un danger potentiel. Toutes les instructions suivant ce symbole doivent être observées, afin d'éviter les dommages de l'équipement et les blessures ou la mort.

Protective Earth (Ground)

Indicates a terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault.

Mise à la terre (Masse)

Indique une borne dont l'usage prévu est d'être connecter à conducteur externe pour assurer la protection contre les chocs électriques en cas de défauts.

Caution Statements

The examples and diagrams in this manual are included solely for illustrative purposes. The information contained in this manual is subject to change at any time and without prior notice. In no event will responsibility or liability be accepted for direct, indirect or consequential damages resulting from the use or application of this equipment.

Mises en garde

Les exemples et les schémas de ce manuel ne sont donnés qu'à titre illustratif. Les informations présentées dans ce manuel peuvent être modifiées sans avis préalable. En aucun cas nous n'assumons la responsabilité ou l'obligation pour les dommages directs, indirects ou consécutifs qui résultent de l'utilisation ou application de cet équipement.

Short Circuit

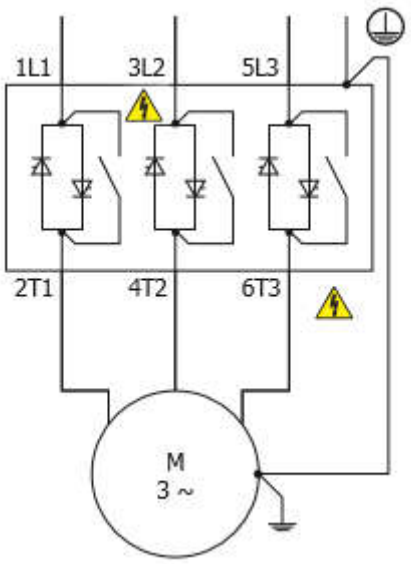
SIT Automation soft starts are not short circuit proof. After severe overload or short circuit, the operation of the soft start should be fully tested by an authorised service agent.

Court-circuit

Les démarreurs progressifs SIT Automation ne sont pas à l'épreuve des courts-circuits. Après une forte surcharge ou un court-circuit, le fonctionnement du démarreur progressif doit être intégralement vérifié par un agent de maintenance agréé.

Safety (continued)

• STS™ soft starts contain dangerous voltages when connected to the mains supply. Only qualified personnel that have been completely trained and authorised, should carry out installation, operation and maintenance of this equipment. *• Les démarreurs progressifs STS ™ contiennent des tensions dangereuses, lorsqu'ils sont connectés à la tension secteur. Les activités d'installation, d'utilisation et d'entretien de cet équipement doivent être effectuées par un personnel qualifié, dûment formé et habilité.*
• Installation of the soft start must be made in accordance with existing local and national electrical codes and regulations and have a minimum protection rating. *• Le démarreur progressif doit être installer conformément au code local et nationale d'électricité et à la réglementation en vigueur, et il doit avoir un indice de protection minimal*
• It is the responsibility of the installer to provide suitable grounding and branch circuit protection in accordance with local electrical safety codes. *• Il appartient à l'installeur d'assurer la mise à la terre et la protection du circuit de branchement, conformément au code de sécurité électrique local.*
• This soft start contains no serviceable or re-usable parts. *• Ce démarreur progressif ne contient pas de pièces réparables ou réutilisables*
• The STOP function of the soft start does not isolate dangerous voltages from the output of the soft start. An approved electrical isolation device must be used to disconnect the soft start from the incoming supply before accessing electrical connections. *• La fonction STOP du démarreur progressif n'isole pas les tension dangereuses en sortie du démarreur progressif. Avant d'accéder aux raccordement électriques, il faut utiliser un dispositif d'isolation électrique approuvé pour déconnecter le démarreur progressif de la tension d'entrée.*



User Manual Revision Guide

Revision History		
Version	Date	Description of Changes
1.0	27/07/2016	Original Issue
2.0	19/08/2016	Corrections

Chapter 1

1. Mechanical Installation

1.1 Mounting

Fix the unit to a flat, vertical surface using the mounting holes (or slots) on its base-plate. The mechanical outline diagrams, shown in section 4.6, give the dimensions and mounting hole positions for each model. Ensure that:

- The orientation of the unit has the 'TOP' uppermost.
- The location allows adequate front access.
- You can view the touchscreen.

Do not install other equipment that generates a lot of heat close to the soft starter.

1.2 Requirements for an Enclosure

For a typical industrial environment, an enclosure would provide the following:

- A single location for the unit and its protection/isolation switch-gear.
- The safe termination of cabling and/or bus-bars.
- Means to effect proper air flow through the enclosure.

1.3 Enclosure Ventilation

When fitting STS™ into a cabinet, ventilation must be provided if the heat output of the unit is greater than the cabinet will dissipate. Use the following formula to determine the fan requirement. An allowance has been incorporated into the formula so that the figure for Q is the air delivery in the fan suppliers data.
The maximum power dissipation occurs when energy saving. Heat dissipated can be approximated with the formula:-
Watts (STS ™) = 1/2 x STS ™ current rating x 3

Ventilation intérieure

Lorsque STS ™ est installé dans une armoire, il faut assurer sa ventilation, si la chaleur produite de l'unité est plus important que la capacité de dissipation de
l'armoire. Utiliser la formule suivante pour déterminer la demande de ventilateur. Une tolérence a été incorporé dans la formule, ainsi la figure donnée dans Q est le débit d'air indiqué dans les données du fournisseur du ventilateur.

La puissance maximale de dissipation est atteint en mode économie d'énergie.
La chaleur dissipée peut être estimée par la formule suivante :
Watts (STS ™) = 1/2 x courant nominal STS ™ x 3

1. Mechanical Installation (continued)

$Q = (4 \times W_t / (T_{max}-T_{amb})$

Q = volume of air (cubic metres per hour-m3/h)
Wt = Heat produced by the unit and all other heat sources within the enclosure (Watts) T_{max} = Maximum permissible temperature within the enclosure (50°C for a fully rated STS™)
T_{amb} = Temperature of the air entering the enclosure (°C) If you prefer to work in CFM, substitute °F for °C. Q is now in CFM

Q = quantité d'air (mètre cube par heure - m3/h)
Wt = Chaleur produite par l'unité et toutes autres sources de chaleur dans l'armoire (Watts)
Tmax = Température maximale admissible dans l'armoire (50°C pour STS ™ en puissance maximale)
Tamb = Température de l'air entrant dans l'armoire (°C)
Pour calculer en CFM, remplacer °C par °F. Ainsi Q est en CFM.

1.4 Altitude

Altitude above sea level 1000m (3281ft). Above 1000m de rate by 1% of STS™ Ie per 100m (328ft) to a maximum altitude of 2000m (6562ft)

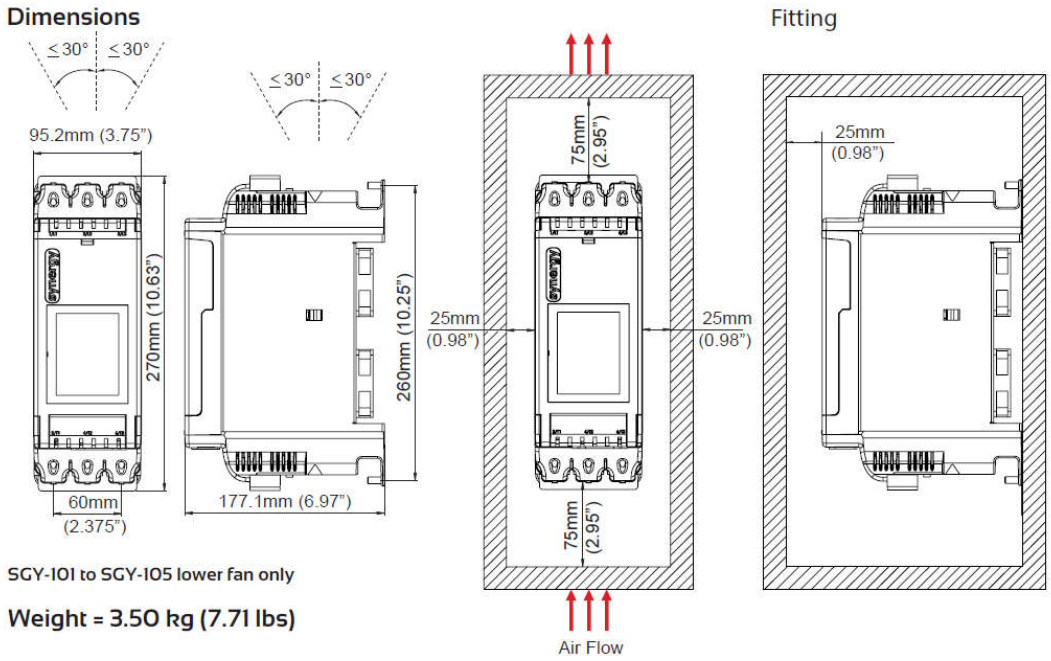
1.5 Derate

-20°C (-4°F) to 50°C (122°F). Above 50°C de-rate linearly by 4% of STS™ Ie per °C to a maximum of 60°C (140°F).

1. Mechanical Installation (continued)

1.6 Dimensions

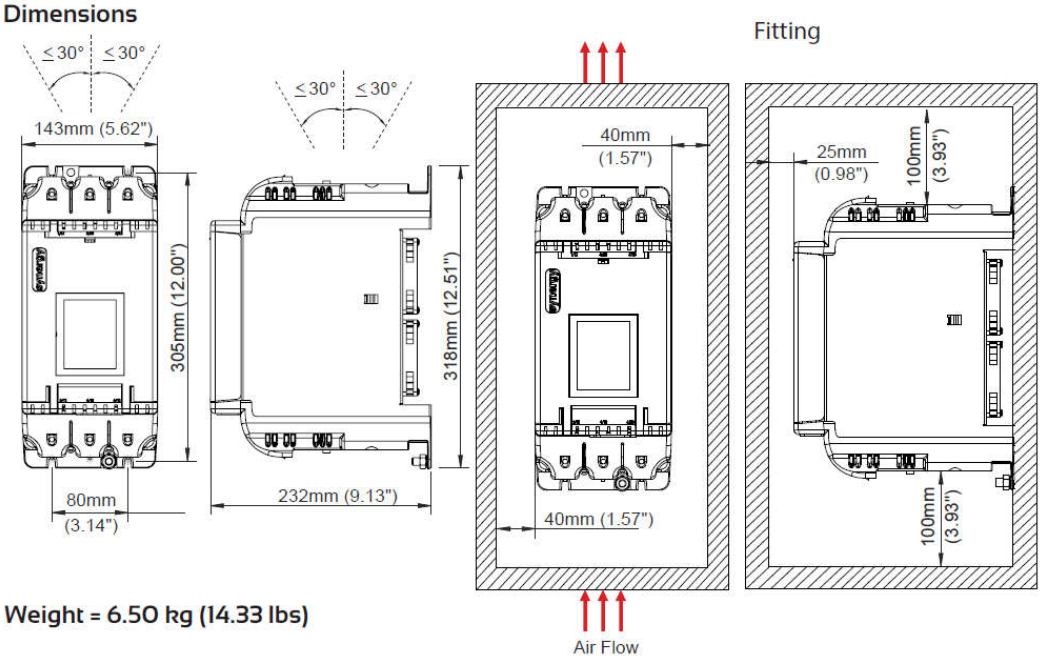
synergy™ Size 1, SGY-101 to SGY-117.



SGY-101 to SGY-105 lower fan only

Weight = 3.50 kg (7.71 lbs)

synergy™ Size 2, SGY-201 to SGY-205

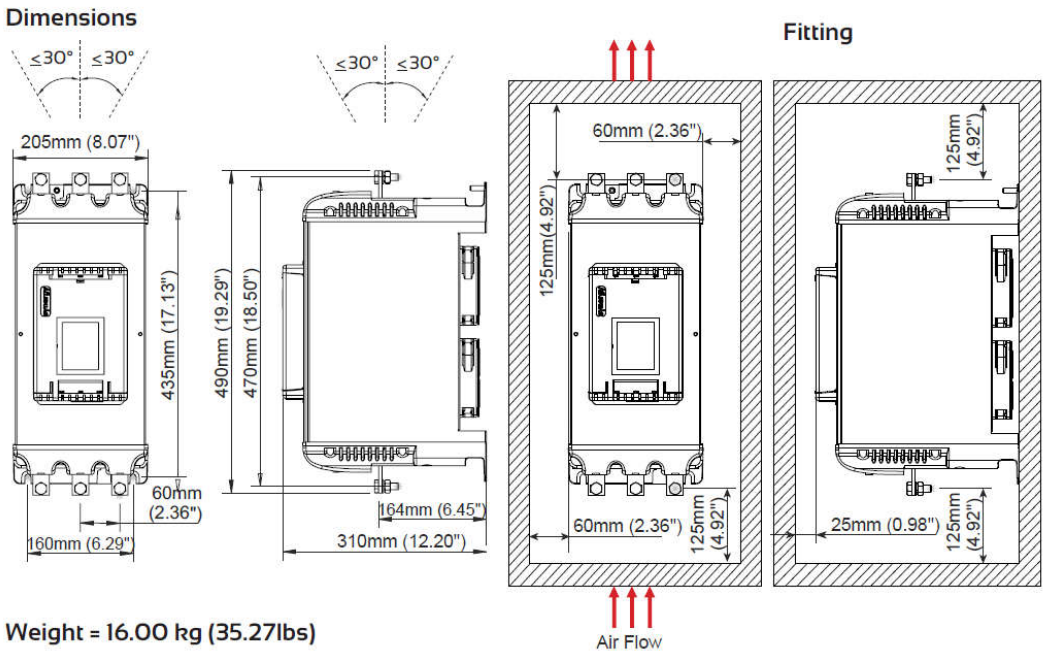


Weight = 6.50 kg (14.33 lbs)

1. Mechanical Installation (continued)

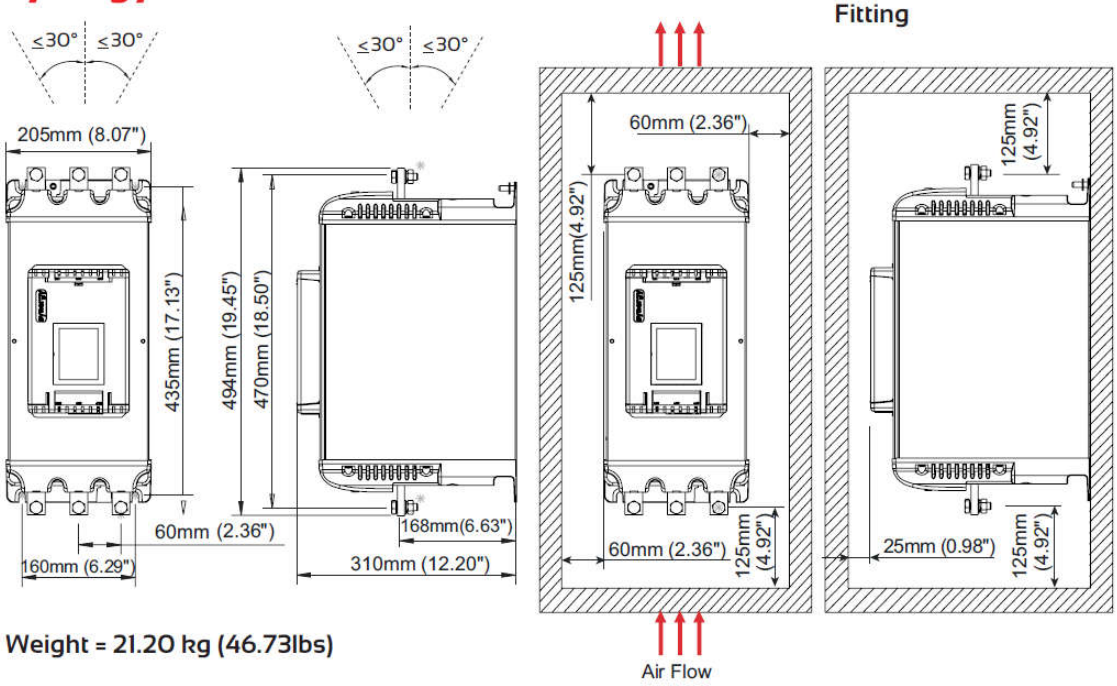
1.6 Dimensions (continued)

synergy™ Size 3, SGY - 301 to SGY - 305



Weight = 16.00 kg (35.27lbs)

synergy™ Size 3, SGY - 307 & SGY - 309

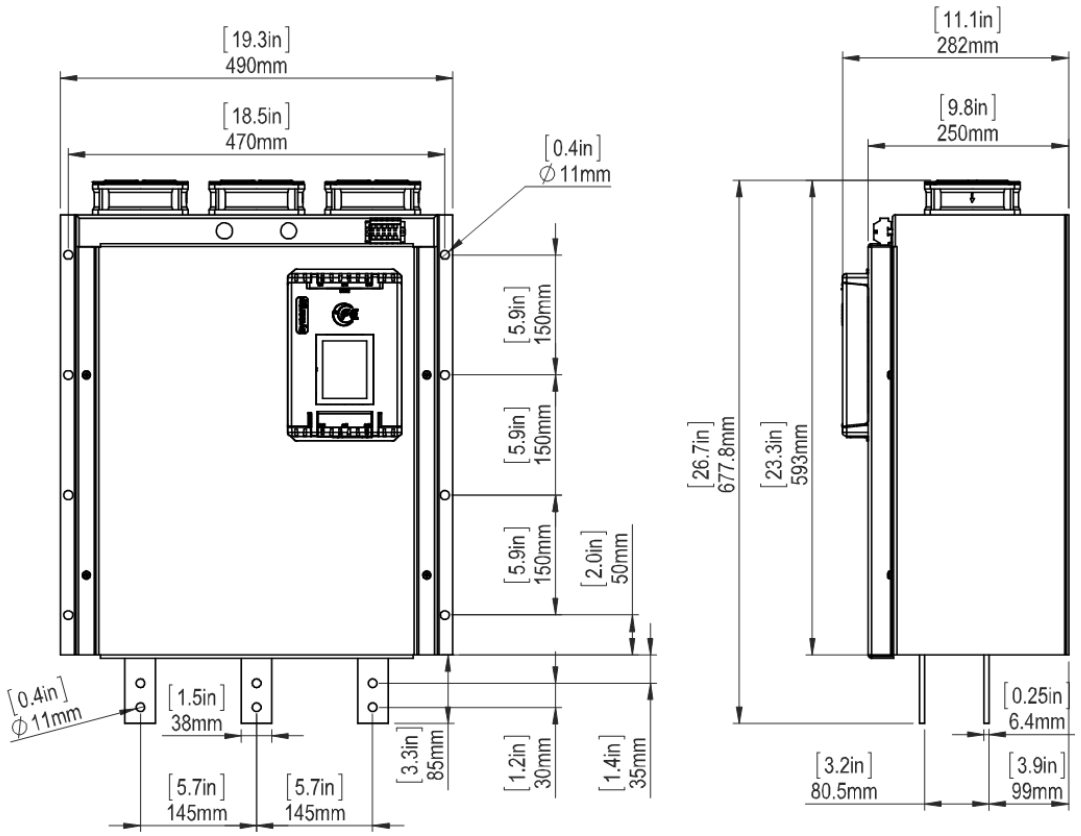


Weight = 21.20 kg (46.73lbs)

1. Dimensioni meccaniche

1.6 Dimensioni

STS-401 to STS-403

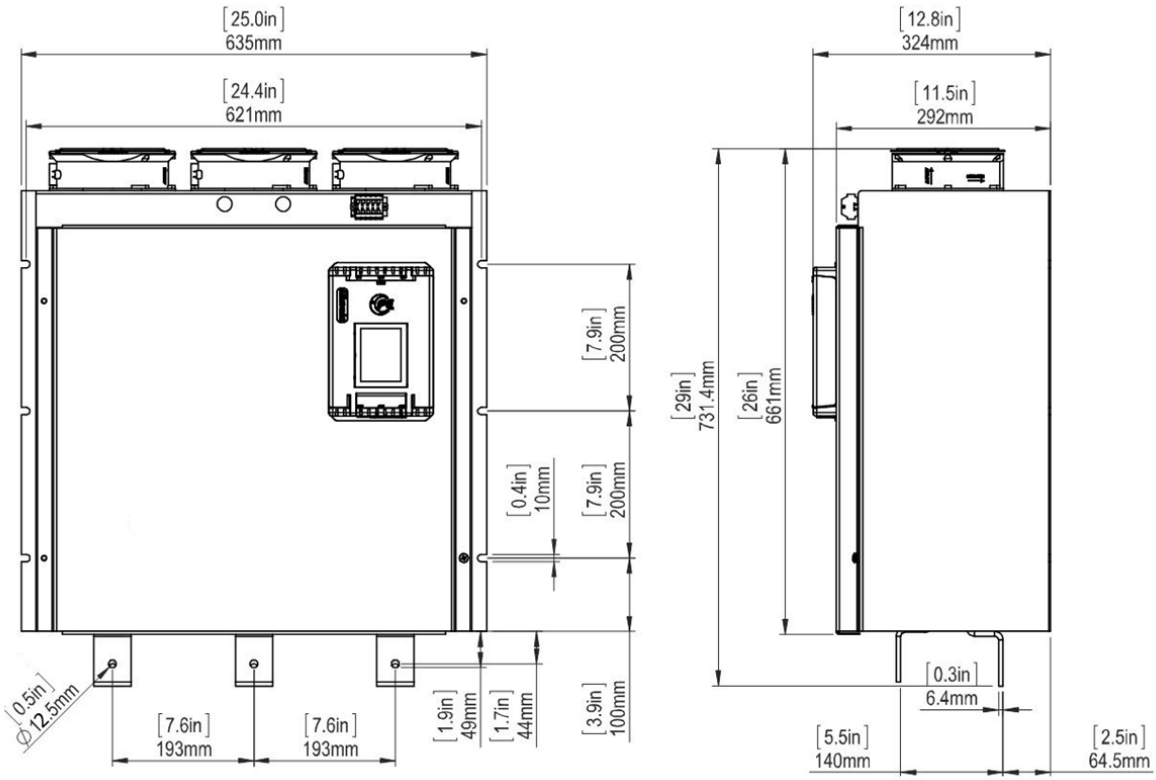


Weight 65kg (143.3lbs)

1. Mechanical Installation (continued)

1.6 Dimensions (continued)

synergy™ STS-501 to STS-505



Weight 72kg (158.7lbs)

1. Mechanical Installation (continued)

1.7 Mechanical Specification

Mechanical Specifications									
Model (STS-)	101	103	105	107	109	111	113	115	117
Frame Size	1								
Heat output (W)	25.5	31.5	40.5	51.0	60.0	78.0	97.5	116	114
Weight kg [lb]	3.0 [6.6]			3.5 [7.7]					
Model (STS-)	201	203	205	301	303	305	307	309	-
Frame Size	2			3					-
Heat output (W)	186	234	270	363	453	542	621	716	-
Weight kg [lb]	5.5 [12.1]	6.5 [14.3]		16.0 [35.3]			21.2 [46.7]		-
Model (STS-)	401	403	501	503	505	-			
Frame Size	4		5			-			
Heat output (W)	1830	2166	2500	2880	3240	-			
Weight kg [lb]	65 [143.3]		72 [158.7]			-			
Model	Models STS-101 to 309								
Ambient Operating Temp.	-20°C [-4°F] to 50°C [122°F] ; above 50°C derate linearly by 4% of STS Ie per °C to a maximum of 60°C (140°F)								
Transportation and Storage Temperature	-20°C to 60°C [-4°F to 140°F] continuous								
Humidity	max 85% non-condensing, not exceeding 50% @ 40°C [104°F]								
Maximum Altitude	1,000m [3281ft] ; above 1000m derate by 1% of STS I_e per 100m (328ft) to a maximum altitude of 2,000m (6562ft)								
Environmental Rating	Main Circuit: IP00 (IP20 with optional finger guards for sizes 1&2 only); Control Circuit: IP20; No corrosive gases permitted								
Model	Models STS-401 to 503								
Ambient Operating Temp.	20°C [-4°F] to 40°C [122°F] ; above 40°C derate linearly by 4% of STS Ie per °C to a maximum of 60°C (140°F)								
Transportation and Storage Temperature	20°C [-4°F] to 50°C [122°F] ; above 50°C derate linearly by 4% of STS Ie per °C to a maximum of 60°C (140°F)								
Humidity	max 85% non-condensing, not exceeding 50% @ 40°C [104°F]								
Maximum Altitude	1,000m [3281ft] ; above 1000m derate by 1% of STS Ie per 100m (328ft) to a maximum altitude of 2,000m (6562ft)								
Environmental Rating	Main Circuit: IP00; Control Circuit: IP20; No corrosive gases permitted								

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Chapter 2

2. Electrical Installation

2.1 Warnings

2.1.1 Isolation

Caution: STS™ uses semiconductor devices in the main circuit and is not designed to provide isolation. For this reason isolation means must be installed in the supply circuit in accordance with the appropriate wiring and safety regulations

2.1.2 Electrical Control Supply Requirements

All electrical connections are made to power input and output terminals, control terminals and an earth stud .

2.1.3 Access

Caution: Always replace the cover on the unit after gaining access to the electrical connections.

2.1.4 Fuse Protection

The Mains Supply and the Control Supply each require protection. Although all units have electronic overload protection for the Soft Start, the installer should always fit fuses, for motor protection, between the unit and the Mains Supply, not between the unit and the motor. Semiconductor fuses can be supplied as an option for short-circuit protection of the semiconductors. These fuses must be fitted externally to the STS™ chassis to comply with certain standards. It is the responsibility of the installer and system designer/specifier to ensure that the required standards or regulations are not affected by so doing.

2.1.5 Safety

STS™ soft starters contain hazardous voltages when connected to the electrical power supply. Only qualified personnel who are trained and authorized should carry out installation, operation and maintenance of this equipment. Refer to and carefully follow all of the 'Warnings' section at the start of this user manual, as well as other warnings and notes throughout the manual.

2. Electrical Installation (continued)

2.2 Electrical Connections

2.2.1 Electrical Supplies

The unit requires a 3-phase balanced Mains Supply to provide the power for the controlled motor. A single-phase supply: 115V to 230V, 50Hz/60Hz, or 24Vdc for the internal control circuitry. The unit will not operate unless the control supply voltage is within the specified limits.

2.3 Technical Information and Standards

All STS™ models are CE, REACH, and RoHS compliant. STS models bear the ETL listing mark and are UL508 and CSA C22.2 No. 14, per ETL, listed to U.S. and Canadian safety standards respectively.

STS Technical Information and Standards			
Rated Operational Voltages	U_e	200VAC to 480VAC	
Rated Operational Current	I_e	See Electrical Specifications table	
Rating Index		STS-101 to 205	I_e: AC-53a: 3.5-17: 90-5
		STS-301 to 309	I_e: AC-53a: 3.5-17: 90-3
		STS-401 to 505	I_e: AC-53a: 3.5-17: 60-3
Rated Frequency		50 to 60Hz	
Rated Duty		Uninterrupted	
IEC 60947-4-2 Form Designation		Form 1 internally bypassed	
Rated Insulation Voltage	U_i	480V	
Rated Impulse Withstand Voltage	U_{imp}	Main circuit	4kV
		Control supply circuit	2.5 kV
IP Code		Main AC line/load circuit	IP00 (IP20 with optional finger guards STS-)
		Supply and control circuit	IP20
Pollution Degree		2	
Rated conditional short-circuit current and type of coordination with associated short-circuit protective device (SCPD).		Type 1 coordination. See short-circuit protection table for rated conditional short-circuit current and required current rating and characteristics of the associated SCPD.	
Rated Control Circuit Voltage (programmable)	U_C	24VDC, 110VAC or 230VAC	Protect with 4A UL Listed fuse
Rated Control Supply Relay Specification	U_S	See Electrical Specifications	
		AC-15 230VAC, 1A	
		DC-13 30VDC, 0.7A	
EMC Emission Levels	EN 55011	Class A	
EMC Immunity Levels	IEC 61000-4-2	8kV/air discharge or 4kV/contact discharge	
	IEC 61000-4-3	10 V/m	
	IEC 61000-4-4	2kV/5kHz (main power and ports)	
		1kV/5kHz (signal ports)	
	IEC 61000-4-5	2kV line-to-ground	
		1kV line-to-line	
	IEC 61000-4-6	10V	

2. Electrical Installation (continued)

2.4 Electrical Specifications

2.4.1 Rating Tables

Rating Table Frame Size 1, 2 and 3									
Type	IEC, I_e	kW [1]		UL,FLA	Hp [2]				
	A [3]	230V	400V	A [4]	200V	208V	220-240V	440-480V	U_s
STS-101-4-01	17	4	7.5	17	3	5	5	10	24Vdc, 110Vac to 230Vac
STS-103-4-01	22	5.5	11	21	5	5	5	15	
STS-105-4-01	29	7.5	15	27	7.5	7.5	7.5	20	
STS-107-4-01	35	7.5	18.5	34	10	10	10	25	
STS-109-4-01	41	11	22	40	10	10	10	30	
STS-111-4-01	55	15	30	52	15	15	15	40	
STS-113-4-01	66	18.5	37	65	20	20	20	50	
STS-115-4-01	80	22	45	77	20	25	25	60	
STS-117-4-01	100	30	55	96	30	30	30	75	
STS-201-4-01	132	37	75	124	40	40	40	100	
STS-203-4-01	160	45	90	156	50	50	60	125	
STS-205-4-01	195	55	110	180	60	60	60	150	
STS-301-4-01	242	75	132	242	75	75	75	200	
STS-303-4-01	302	90	160	302	100	100	100	250	
STS-305-4-01	361	110	200	361	125	125	150	300	
STS-307-4-02	430	132	250	414	150	150	150	350	110Vac
STS-309-4-02	500	150	280	477	150	150	150	400	
STS-307-4-03	430	132	250	414	150	150	150	350	230Vac
STS-309-4-03	500	150	280	477	150	150	150	400	

1) Rated operational powers in kW according to IEC 60072-1 (primary series) corresponding to IEC current rating.
2) Rated operational powers in hp according to UL508 corresponding to FLA current rating.
3) The IEC, Ie rating applies for EN 60947-4-2 max rating index 195A: AC-53a: 3.5-17: 90-5 and 500A: AC-53a: 3.5-17: 90-3
4) The UL, FLA rating applies for a maximum surrounding air temperature of 50°C.

Frame Size 4 and 5									
Type	IEC, I_e	kW [1]		UL,FLA	Hp [2]				U_s
	A [3]	230V	400V	A [4]	200V	208V	220-240V	440-480V	
STS-401-4-02	610	200	355	590	200	200	200	500	110Vac
STS-403-4-02	722	220	400	722	250	250	300	600	
STS-501-4-02	850	280	500	840	300	300	350	700	
STS-503-4-02	960	315	560	960	300	350	400	800	
STS-505-4-02	1080	355	630	1080	350	400	450	900	
STS-401-4-03	610	200	355	590	200	200	200	500	230Vac
STS-403-4-03	722	220	400	722	250	250	300	600	
STS-501-4-03	850	280	500	840	300	300	350	700	
STS-503-4-03	960	315	560	960	300	350	400	800	
STS-505-4-03	1080	355	630	1080	350	400	450	900	

Rated operational powers in kW according to IEC 60072-1 (primary series) corresponding to IEC current rating
Rated operational powers in hp based on Table 430.250 of the National Electrical Code, 2005® corresponding to FLA current rating.
Ie rating applies for EN 60947-4-2 max rating index 1080A: AC-53a: 3.5-17: 60-3
Ratings apply for a maximum surrounding air temperature of 40°C.

2. Electrical Installation (continued)

2.5 Short Circuit Protection

Type designation (eg. STS-101-4-01)			STS101	STS103	STS105	STS107	STS109	STS111	STS113	STS115	STS117
Rated operational currents	I_e	A	17	22	29	35	41	55	66	80	100
Rated conditional short circuit current	I_q	kA	5	5	5	5	5	5	5	10	10
Class J time-delay fuse #1	Maximum rating Z_1	A	30	40	50	60	70	100	125	150	175
UL Listed inverse-time delay circuit breaker #1	Maximum rating Z_2	A	60	60	60	60	60	150	150	250	300
Semiconductor fuse (class aR) #2	Type		Mersen 6,9 URD 30 _ Bussmann 170M30__ Bussmann 170M31__ Bussmann 170M32__ SIBA 20 61___								
	Fuse rating	A	100A	100A	160A	160A	160A	200A	200A	250A	315A

Type designation (eg. STS-201-4-01)			STS201	STS203	STS205	STS301	STS303	STS305	STS307	STS309
Rated operational currents	I_e	A	132	160	195	242	302	361	430	500
Rated conditional short circuit current	I_q	kA	10	10	10	18	18	18	18	18
Class J time-delay fuse #1	Maximum rating Z_1	A	225	300	350	450	500	500	600	600
UL Listed inverse-time delay circuit breaker #1	Maximum rating Z_2	A	350	450	500	700	800	1000	1000	1000
Semiconductor fuse (class aR) #2	Type		Mersen 6,9 URD 31__ Bussmann 170M40__ Bussmann 170M41__ Bussmann 170M42__ SIBA 20 61___			Mersen 6,9 URD 33__ Bussmann 170M60__ Bussmann 170M61__ Bussmann 170M62__ SIBA 20 63___				
	Fuse rating	A	400A	550A	550A	700A	800A	900A	1000A	1100A

Type designation (eg. STS-401-4-02)			STS401	STS403	STS501	STS503	STS505
Rated operational currents	I_e	A	610	722	850	960	1080
Rated conditional short circuit current	I_q	kA	30	30	42	42	42
Semiconductor fuse (class aR) #2	Bussmann Type		170M5466		170M6467		
	Siba Type		2067132.1000A		2068132.1400A		

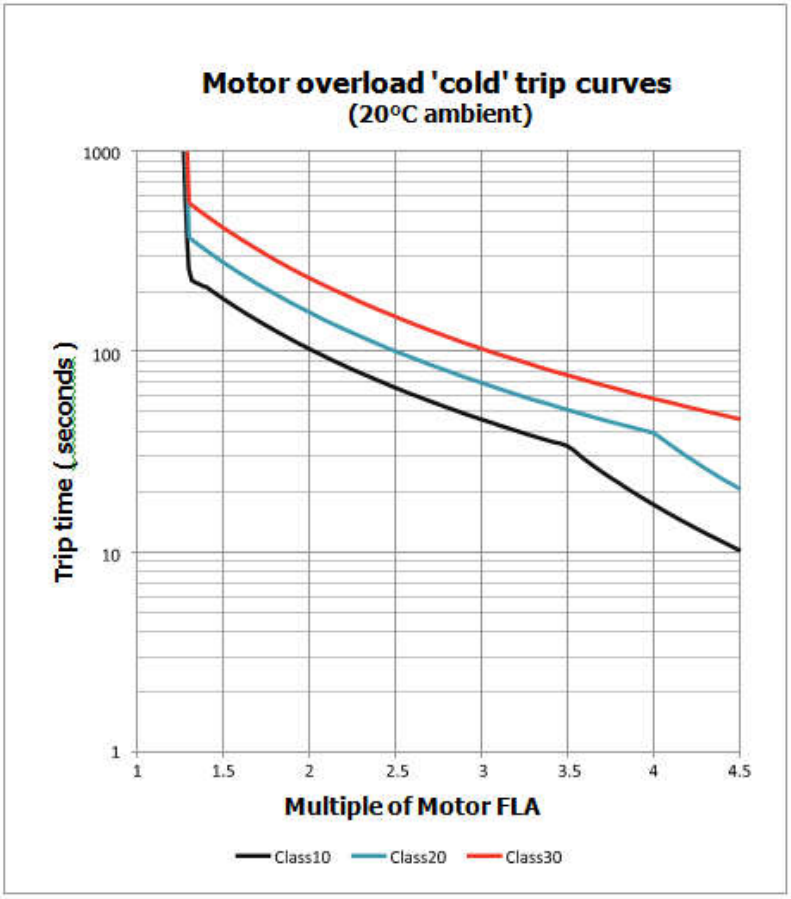
#1 Suitable For Use On A Circuit Capable Of Delivering Not More Than ___I_q___ rms Symmetrical Amperes, 480 Volts Maximum, When Protected by Class J time delay Fuses with a Maximum Rating of ___Z_1___ or by a Circuit Breaker with a Maximum Rating of ___Z_2___.

#2 Correctly selected semiconductor fuses can provide additional protection against damage to the STS unit (This is sometimes referred to as type 2 co-ordination). These semiconductor fuses are recommended to provide this increased protection.

2. Electrical Installation (continued)

2.6 Motor Overload Protection

STS™ provides full motor overload protection, configurable through the user interface. Overload trip settings are determined by the Motor Current setting and the Trip Class setting. Trip class choices are Class 10, Class 20, and Class 30. The STS™ soft starters are protected using full I^2T motor overload with memory. See Appendix 1 for sizing guide.



2. Electrical Installation (continued)

2.7 Wire Sizes and Torques

Terminal		Models	Wire/Busbar Size Metric	Imperial	Torque Nm	lb-in
Main Terminals Cu STR 75°C only	Terminal	STS101 to STS117	2.5 - 70mm²	12- 2/0AWG	9	80
		STS201 to STS205	4 - 185mm²	12 – 350MCM	14	123
	M10 bolt	STS301 to STS305	2 x 95mm²	2 x 2/0AWG		
		STS307 to STS309	2 x 150mm²	2 x 350MCM		
Main Terminals [2] Copper busbar	2 x M10 bolt	STS401 to STS403	50mm x 10mm	1.5in x 0.5in		
	M12 bolt	STS501 to STS503	60mm x 10mm	2.0in x 0.5in		
		STS505	80mm x 10mm	2.5in x 0.5in		
Control terminals		All models	0.2–1.5mm²	24-16AWG	0.5	4.5
Protective Earth [1] Cu only	M6 stud	STS101	≥ 4mm²	≥ 12AWG	8	70
		STS103 to STS111	≥ 6mm²	≥ 10AWG		
		STS113 to STS117	≥ 10mm²	≥ 8AWG		
	M8 stud	STS201 to STS205	≥ 16mm²	≥ 6AWG	12	105
		STS301	≥ 25mm²	≥ 4AWG		
		STS303 to STS305	≥ 35mm²	≥ 3AWG		
		STS307 to STS309	≥ 35mm²	≥ 2AWG		
		STS401 to STS403	≥ 70mm²	≥ 1/0AWG		
	M10 stud	STS501 to STS505	≥ 70mm²	≥ 2/0AWG		
		STS505	≥ 95mm²	≥ 3/0AWG		

Protective Earth wire size based on bonding conductor requirements of UL508 Table 6.4 and UL508A Table 15.1.
Maximum busbar sizes based on IEC 60947-1 Table 11. The actual conductor used must comply with local wiring regulations.

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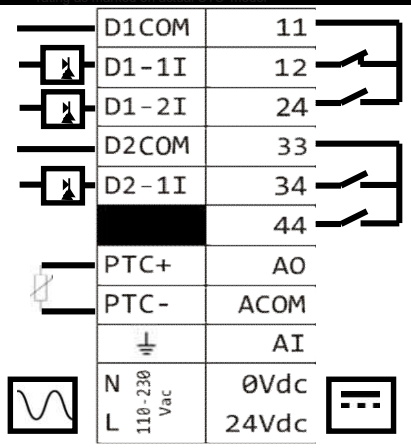
2. Electrical Installation (continued)

2.8 Electrical Connections

⚠	Required rating	Programmable	Default	Description
#1				Group 1 input common
#1	SEE TABLE 1, U_C	yes	start/ stop	opto-coupled input
#1	SEE TABLE 1, U_C	yes	None	opto-coupled input
				group 2 input common
	SEE TABLE 1 ,U_C	yes	reset	opto-coupled input
				not used
	3 x PTC in series (130°C)		OFF	thermistor
	3 x PTC in series (130°C)		OFF	thermistor
				signal ground
#3	SEE TABLE 1 U_S			control supply
#3	SEE TABLE 1 U_S			control supply

Representative of terminal label. See TABLE 1, U_S for AC supply rating as marked on actual STS model



Description	Default	Programm-able	Required rating	⚠
group 1 relay common				
relay N/C	fault	yes	230Vac 1A AC15, 30Vdc 0.5A Resistive	
relay N/O	fault	yes	230Vac 1A AC15, 30Vdc 0.5A Resistive	
group 2 relay common				
relay N/O	running	yes	230Vac 1A AC15, 30Vdc 0.5A Resistive	
relay N/O	end of start	yes	230Vac 1A AC15, 30Vdc 0.5A Resistive	
analog output	0-10V	yes	0 to 10V 10mA / 4-20mA	
analog 0V			0V	
analog input	0-10V	Yes	0 to 10V 10mA / 4-20mA	
control supply			SEE TABLE 1 , U_S	#3
control supply			SEE TABLE 1, U_S	#3

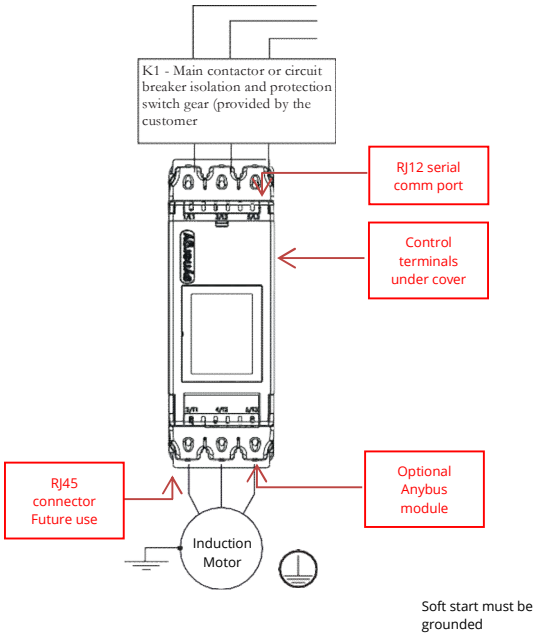
Model No (s):	US (+10% -15%)	UC (+10% -15%)	Notes
STS-101-4-01 to STS-305-4-01	*110 - 230Vac or 24Vdc*	*110Vac or 230Vac or 24Vdc.230Vac factory default. 230Vac défaut d'usine.#4*	*The system can have either a 110/230Vacmains or 24Vdc input NOT both. Le système peut avoir soit une alimentation principale de 110/230 Vac ou de 24 Vdc, mais en aucun cas les deux simultanement.*
STS-307-4-02 / STS-309-4-02	*110Vac*		
STS-307-4-03 / STS-309-4-03	*230Vac*		
STS-401-4-02 to STS-505-4-02	*110V ac*		
STS-401-4-03 to STS-503-4-03	230Vac		

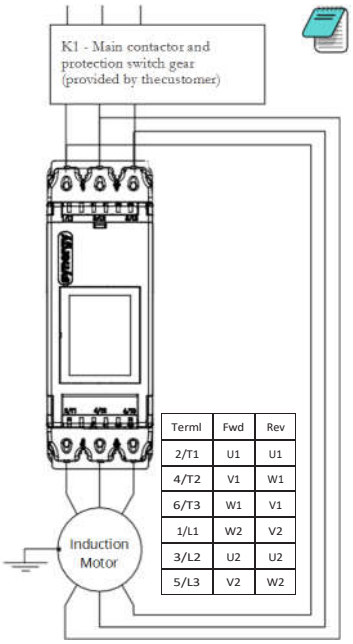
24Vdc Specification
24Vdc 60W
Residual ripple 100mV
Spikes/switching Peaks 240mV
Turn On/Off response
No overshoot of V out
Overvoltage voltage protection output
voltage must be clamped to <30Vdc

Notes	
#1	**The programmed digital input setting on D1COM, D1-1I, D1-2I must correspond to the voltage applied to these terminals to avoid risk of damage to the equipment. Afin d'éviter d'endommager l'équipement, le réglage de l'entrée numérique programmé sur D1COM, D1-1I, D1-2I doit correspondre à la tension appliquée à ces bornes.**
#2	**The programmed digital input setting on D2COM, D2-1I must correspond to the voltage applied to these terminals to avoid risk of damage to the equipment. Afin d'éviter d'endommager l'équipement, le réglage de l'entrée numérique programmé sur D2COM, D2-1I doit correspondre à la tension appliquée à ces bornes.**
#3	**The control supply can be 110 to 230Vac applied to the N, L terminals or 24Vdc applied to the 0Vdc, 24V input terminals. The correct voltage as specified must only be applied to one of these supply inputs to avoid risk of damage to the equipment.** **L'alimentation contrôle peut être 110 ã 230 Vca, appliquée aux bornes N et L, ou 24 Vcc, appliquée aux bornes d'entrée de 0 Vcc, 24 V. Afin d'éviter d'endommager l'équipement, la tension appropriée selon les indications ne doit être appliquée qu'à une entrée d'alimentation.**
#4	**See Section 3.10**

2. Electrical Installation (continued)

2.9 Electrical Wiring





Note: Circuit breaker isolation alone is not allowed for In Delta operation. K1 (Main contactor) controlled by the Running relay MUST be used for isolation.

⚠ For suitable short circuit protection devices (SCPD's) see Short Circuit Protection in the Technical Information / Standards section of this guide.

Pour un dispositif de protection approprié contre le court-circuit, voir la protection contre le court-circuit dans la section « Informations techniques/normes » du présent guide.

⚠ For wire size and torque requirements see Technical Information / Standards section of this guide.

Pour les dimensions de câble et les besoins en couple, voir la section « Informations techniques/normes » du présent guide

⚠ **In Delta**

For this configuration applying the equation. STS™ Ie =

ie (motor)/$\sqrt{3}$

Allows lower current ratingSTS™ than the motor.

When In Delta configuration is used a line contactor controlled by STS™ **MUST** be used with the In Delta Firing Mode selected in the advanced menu.

⚠ ***En Delta***

Pour cette configuration, appliquer l'équation. suivante : STS™ Ie = Ie (moteur)/ $\sqrt{3}$

Cela permet le courant nominal inférieur de STS ™ *par rapport au moteur.*

Lorsque En Delta configuration est utilisée, **IL FAUT** *utiliser un sectionneur principal contrôlé par* STS ™, *En Delta mode de fonctionnement, sélectionné dans le menu avancé.*

2. Electrical Installation (continued)

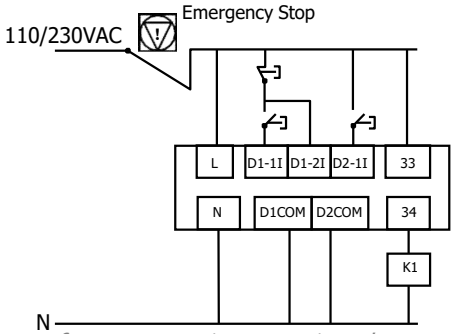
2.9 Control Wiring

1) The programmed digital input settings for D1COM , D1-1I, D1-2I, and D2COM , D2-1I must correspond to the voltage applied to these terminals to avoid risk of damage to the equipment.

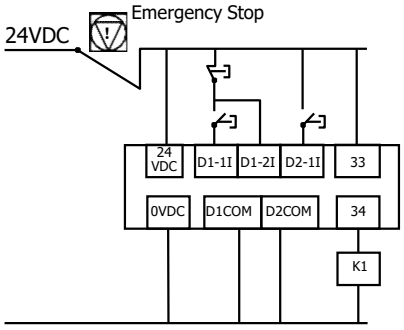
2) The control supply can be 110 to 230VAC applied to the N, L terminals or 24VDC applied to the 0VDC, 24V input terminals. The correct voltage as specified must only be applied to one of these supply inputs to avoid risk of damage to the equipment.

2.9.1 Three Wire Control

3 Wire Control Diagram 110/230Vac control supply (U_s) and digital input (U_c) programming.



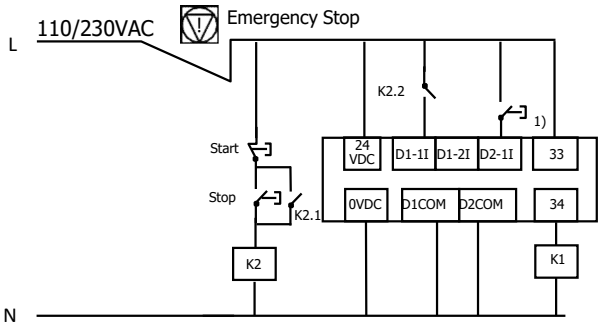
3 Wire Control Diagram 24Vdc control supply (U_s) and digital input (U_c) programming (only applicable to STS-101 to STS-305)



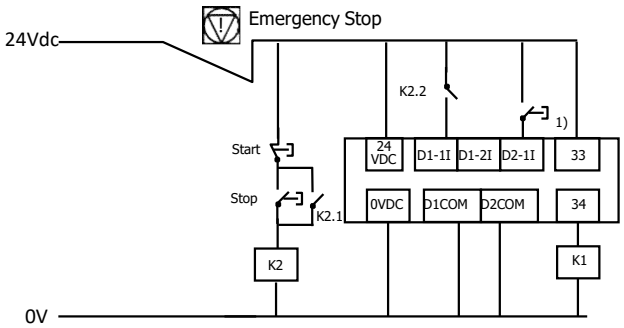
Power factor correction capacitors must not be positioned between the soft starter and the motor, or there is a risk of damaging the thyristors due to current peaks.*

2.9.2 User Programmable Control

110/230Vac (U_s) and user (U_c) Programmable control diagram



24Vdc (U_s) and user (U_c) Programmable control diagram Only applicable for STS-101 to STS-305



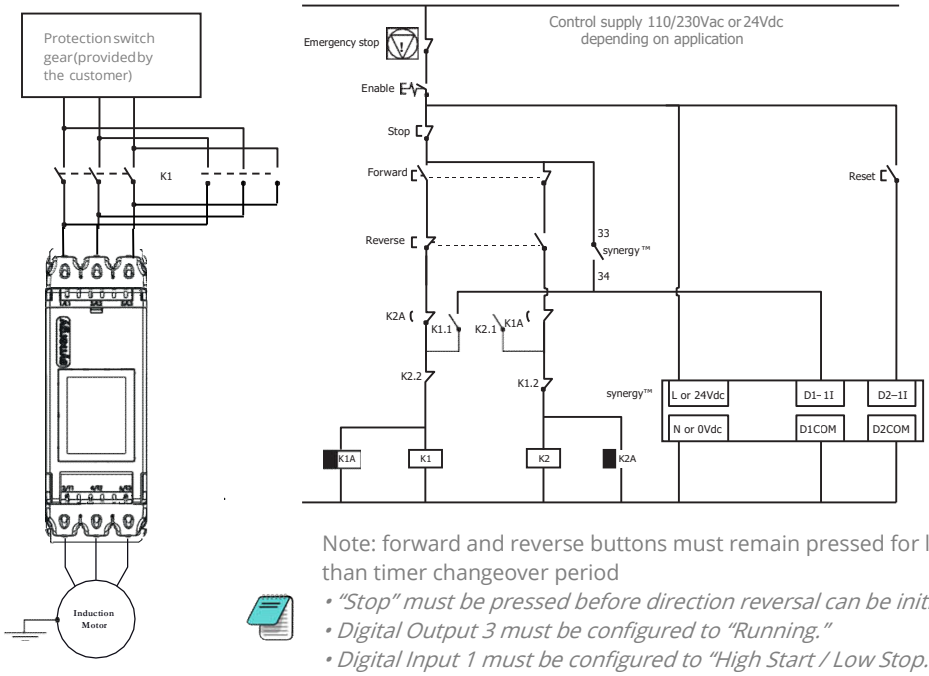
1) Optional high reset. If this reset is required, ensure that "User Programmable" is selected as the control method menu found in the Digital Inputs menu. If you would prefer the reset to work by removing and reapplying the Start Signal on D1-1I then select "Two wire control" in the control method menu.

Digital Input Configuration	Digital Output Configuration
D1-1I = High Start / Low Stop	34 = DO3 set to "Running" (This pulls in the line contactor, K1, before the ramp starts)
D1-2I = None	
D2-1I = High Reset	

2. Electrical Installation (continued)

2.9.3 Reversing Configuration

Soft start reversing circuit without soft stop, it shows the main components required. You must follow your local wiring and electrical regulations when constructing this circuit, set to 'User Programmable' control



Note: forward and reverse buttons must remain pressed for longer than timer changeover period

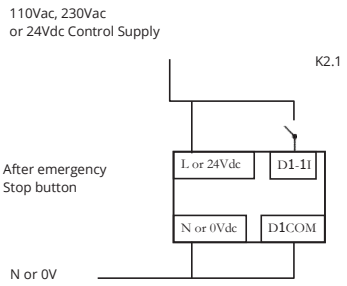
- *"Stop" must be pressed before direction reversal can be initiated.*
- *Digital Output 3 must be configured to "Running."*
- *Digital Input 1 must be configured to "High Start / Low Stop."*
- *Digital Input 2 must be configured to "Reset."*

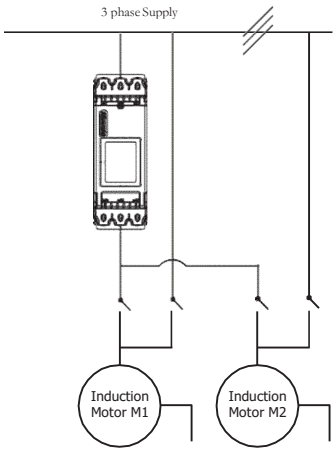
Item	Description
K1, K2	AC3 rated forward/reverse
K1A, K2A	1 second drop out delay timers
STS™	STS™ soft start

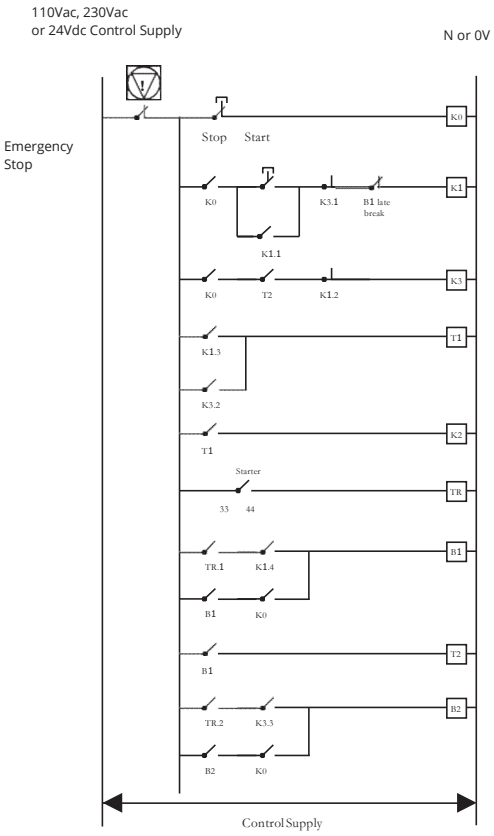
These are the major components of the system. Local wiring regulations should be observed. Note the use of timers to ensure that a reversed voltage is not applied to the starter/motor before the motor field has had some chance to die away.
The thermal capabilities of STS™ should be considered.

2. Electrical Installation (continued)

2.9.4 Sequential Soft Start Configuration







Notes:
Soft Starter must have stop time set to 0 T1 Time between K1 or K3 closing and the starter being energised - 0.5 sec minimum.
T2 Time between B1 closing and K3 closing -Dependant on application - 0.5 sec minimum

Set to 'Two wire control'

Emergency stop switch cuts off control supply and drops out starter and motors.
Stop switch drops control supply from contactors and timers stopping both motors.
Start switch initiates softstart then bypass of motor 1 immediately followed by softstart then bypass of motor 2.

Soft Starter must be rated for combined starting duty.

The control logic can be continued for more motors.

The thermal capabilities of STS™ should be considered.

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3. Configuration and Parameters

Chapter 3

3.1 Status LED

The LED on the STS front panel will blink once every 10 seconds to provide visual confirmation that all microprocessors in the soft starter are operating properly.

3.2 Configuration Overview

Configuring STS soft starters is as simple as setting the parameters to match your motor, application, power source, control scheme, etc.
You can configure STS from its touchscreen, from an optional remote touchscreen, or from a PLC using Modbus RTU via the onboard RJ12 connector.

3.2.1 Auto Setup Procedure

Allow the user to change all of the parameters at once to settings that are typical for general applications. One or more parameters as can be adjusted to fine tune the settings for your specific application.

3.2.2 Setup by Individual Parameter Settings

Allows the user to change the parameter settings one at a time.The individual parameters are grouped by categories as on the touchscreen.

3.3 Configuration From Touchscreen

Use the the on-screen buttons to enter data or to scroll through setup menus, using the “Up,” Dn,” “BACK,” and “NEXT” buttons as necessary. From the home “Menu” screen, select either “Auto Setup” or “Advanced.”

3.3.1 Auto Setup

On initial power up, STS will show a ‘Setup Wizard’ menu – Auto and Advanced. To jump immediately to the pre-defined parameter sets, press the Auto button and follow the on-screen prompts. Refer to the example on the following screen.

To automatically set up parameters on subsequent start-up, select the ‘Home’ menu from the status screen and select ‘Auto Setup’. Follow the on-screen prompts. Refer to the example on the following screen.

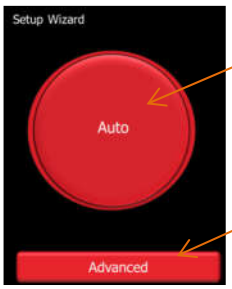
3.3.2 Individual Parameter Setup

From the Setup Wizard or Home menu, select the ‘Advanced’ menu. Set the required parameters from the displayed menus. See Section 3.8 for detailed descriptions of the available parameters.

3. Configuration and Parameters (continued)

3.4 On Screen Menus

Initial Screen

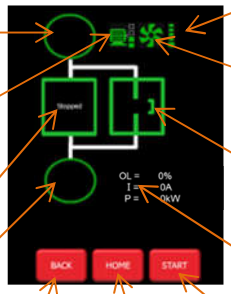


Displayed on FIRST switch-on ONLY.

Auto Setup wizard.
See Section 3.5

Advanced menu
See Section 3.8

Status Screen



Temperature Status.
Turns RED if unit has tripped on over temperature

Supply Status.
Turns RED if unit has tripped on supply failure

Cooling Fan Status.
Turns RED if unit has tripped on fan failure

Motor Overload Status.
Turns RED if unit has tripped on overload

Internal Bypass Status (open/closed)

Status Messages

Displays Overload Percentage, Instantaneous running Current and power

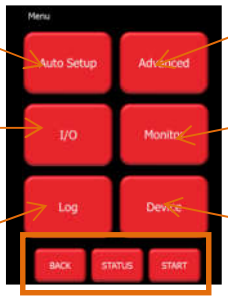
Motor Side Status.
Turns RED if unit has tripped on motor side phase loss

Start/Stop Motor.
Only active if Local Control Enabled

Returns to previous screen/menu

Enters Sub-Menus

'Home' Menus



Auto-Setup Menu
See Sections: 3.5, 3.6, 3.8

Advanced Menus
See Section: 3.9

Input/Output Menus
See Section: 3.10

Monitor Screens
See Section: 3.11

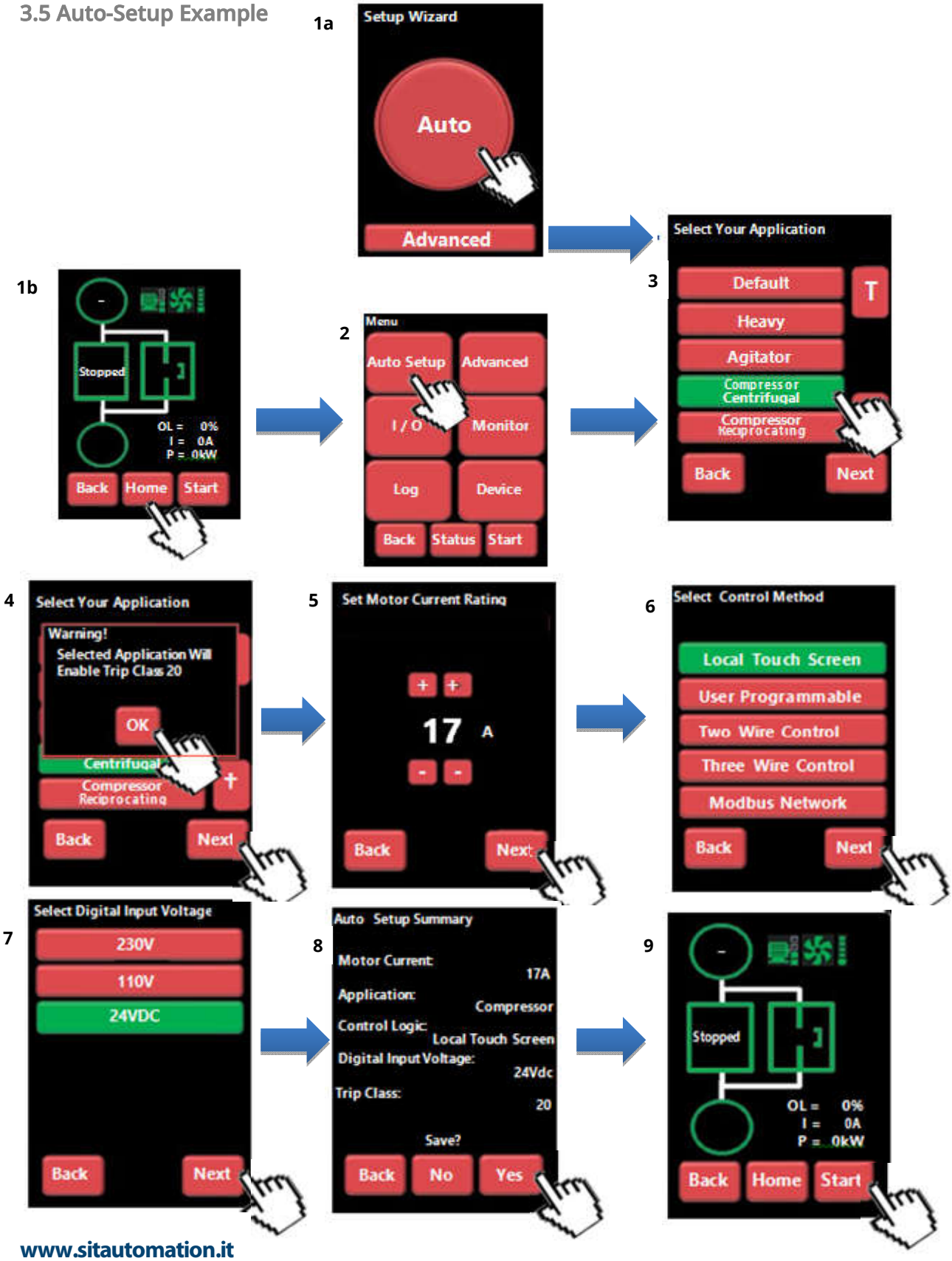
Logging Menus
See Section: 3.12

Device Menus
See Section: 3.13

See 'Status Screen'

3. Configuration and Parameters (continued)

3.5 Auto-Setup Example



3. Configuration and Parameters (continued)

3.6 Auto-Setup Parameter Settings

AutoSetupParameter																					
		Start pedestal	Stop pedestal	Start time	Soft stop time	Trip Class	Current limit level	Current limit time	Optimize rate	Auto pedestal	Auto End Start 2	Auto End Start 1	Auto End 3	Delta Operation	Auto stop	Soft stop smoothing	spare	Auto ramp	Auto end stop	Impact load	Current limit - stopping	Current limit time -
–	Unit	%	%	s	s	–	FL	s	–	En	En	En	En	En	En	En	En	En	En	En	FL	s
0	Default	20	10	10	0	10	3.5	30	5	0	0	0	1	1	0	0	0	0	0	0	8	2
1	Heavy	40	10	10	0	20	4	40	5	1	0	1	1	1	0	0	0	0	0	0	8	2
2	Agitator	30	10	10	0	10	3.5	25	5	1	0	1	1	1	0	0	0	0	0	0	8	2
3	Compressor - Centrifugal	35	10	15	0	20	3.5	25	5	1	0	1	1	1	0	0	0	0	0	0	8	2
4	Compressor - Reciprocating	45	10	15	0	20	3.5	25	15	1	0	1	1	1	0	0	0	0	0	0	8	2
5	Compressor - Screw	40	10	15	0	20	3.5	25	5	1	0	1	1	1	0	0	0	0	0	0	8	2
6	Compressor - Vane	35	10	7	0	10	3.5	25	5	1	0	1	0	1	0	0	0	0	0	0	8	2
7	Compressor - Scroll	35	10	7	0	10	3.5	25	15	1	0	1	0	1	0	0	0	0	0	0	8	2
8	Ball mill	40	10	10	0	20	5.5	25	5	1	0	1	0	1	0	0	0	0	0	0	8	2
9	Centrifuge	40	10	10	0	30	2.5	300	5	1	0	1	0	1	0	0	0	0	0	0	8	2
10	Bow Thruster - Zero Pitch	10	10	10	0	10	2.5	25	5	1	1	0	1	1	0	0	0	0	0	0	8	2
11	Bow Thruster - Loaded	10	10	10	0	20	4	25	5	1	1	0	1	1	0	0	1	0	0	0	8	2
12	Conveyor - Unloaded	10	10	10	7	10	3.5	30	5	1	0	1	0	1	1	1	1	0	1	0	2	10
13	Conveyor - Loaded	10	10	10	7	20	5.5	30	5	1	0	1	0	1	1	1	0	0	1	0	2	10
14	Crusher	40	10	10	0	30	3.5	60	5	1	0	1	0	1	0	0	0	0	0	0	8	2
15	Fan - Low Inertia	30	10	15	0	10	3.5	30	5	1	0	1	0	1	0	1	0	0	0	0	8	2
16	Fan - High Inertia	40	10	10	0	30	3.5	60	5	1	0	1	0	1	0	0	0	0	0	0	8	2
17	Feeder - screw	20	10	10	0	10	3.5	25	5	1	0	1	0	1	0	0	0	0	0	0	8	2
18	Grinder	40	10	10	0	20	3.5	40	5	1	0	1	0	1	0	0	0	0	0	0	8	2
19	Hammer mill	40	10	10	0	20	3.5	40	5	1	0	1	0	1	0	0	0	0	0	0	8	2
20	Lathe machines	10	10	15	0	10	3.5	25	5	1	0	1	0	1	0	0	0	0	0	0	8	2
21	Mills - flour Etc	40	10	10	0	20	3.5	40	5	1	0	1	0	1	0	0	0	0	0	0	8	2
22	Mixer - Unloaded	10	10	10	0	10	3.5	25	5	1	0	1	0	1	0	0	0	0	0	0	8	2
23	Mixer - Loaded	10	10	10	0	20	4	25	5	1	0	1	0	1	0	0	0	0	0	0	8	2
24	Moulding Machine	10	10	10	0	10	4.5	25	5	1	0	1	0	1	0	0	0	0	0	1	8	2
25	Pelletisers	40	10	10	0	20	5.5	25	5	1	0	1	0	1	0	0	0	0	0	0	8	2
26	Plastic and textile machines	10	10	10	0	10	4.5	25	5	1	0	1	0	1	0	0	1	0	0	1	8	2
27	Press, flywheel	40	10	10	0	20	3.5	40	5	1	0	1	0	1	0	0	1	0	0	1	8	2
28	Pump - Submersible Centrifugal	10	10	10	60	10	3.5	25	5	1	0	0	0	1	1	1	1	0	1	0	2	25
29	Pump - Submersible	10	10	10	60	10	3.5	25	5	1	0	0	0	1	1	1	1	0	1	0	2	25
30	Pump - Positive displacement Reciprocating	10	10	10	60	20	3.5	25	15	1	0	0	0	1	1	1	0	0	1	0	2	25
31	Pump - Positive displacement Rotary	10	10	10	60	20	3.5	25	15	1	0	0	0	1	1	1	0	0	1	0	2	25

(Continued on next page)

3. Configuration and Parameters (continued)

Auto Setup Parameter Settings (continued)																						
		Start pedestal	Stop pedestal	Start time	Soft stop time	Trip Class	Current limit level	Current limit time	Optimize rate	Auto pedestal	Auto End Start 2	Auto End Start 1	Auto End 3	Delta Operation	Auto stop	Soft stop smoothing	spare	Auto ramp	Auto end stop	Impact load	Current limit - stopping	Current limit time -
	Unit	%	%	s	s	–	FL	s	–	En	En	En	En	En	En	En	En	En	En	En	FL	s
32	Pump Jack	40	10	10	0	20	3.5	40	5	1	0	1	0	1	0	0	0	0	0	1	8	2
33	Rolling mill	40	10	10	0	20	3.5	40	5	1	0	1	0	1	0	0	0	0	0	0	8	2
34	Roots Blower	30	10	10	0	20	4.5	25	5	1	0	1	0	1	0	0	0	0	0	0	8	2
35	Saw - Band	10	10	10	0	10	3.5	25	5	1	0	1	0	1	0	0	0	0	0	0	8	2
36	Saw - Circular	40	10	10	0	20	3.5	40	5	1	0	1	0	1	0	0	0	0	0	0	8	2
37	Screen - vibrating	40	10	10	0	20	4.5	40	5	1	0	1	0	1	0	0	0	0	0	0	8	2
38	Shredder	40	10	10	0	30	3.5	60	5	1	0	1	0	1	0	0	0	0	0	0	8	2
39	Transformers, voltage	10	10	5	0	10	3.5	25	5	0	0	0	0	1	0	0	0	0	0	0	8	2
40	Tumblers	20	10	10	0	20	4	25	5	1	0	1	0	0	0	0	0	0	0	0	8	2
41	Wood chipper	40	10	10	0	30	3.5	60	5	1	0	1	0	0	0	0	0	0	0	0	8	2

3. Configuration and Parameters (continued)

3.7 Parameter Summary

3.7.1 Summary – Parameters for Touchscreen Setup – "Advanced" Category

Group	Parameter	Units	Range	Read / Write	Modbus		Default Setting	User Setting
					Dec	Hex		
Save Parameters		toggle	NO / YES	R/W	62144	F2C0	NO	
(P2) Automatic Settings	Automatic Pedestal	toggle	OFF / ON	R/W	19840	4D80	OFF	
	Automatic Ramp	toggle	OFF / ON	R/W	20352	4F80	OFF	
	Automatic End Start (1)	toggle	OFF / ON	R/W	19968	4E00	OFF	
	Automatic Stop	toggle	OFF / ON	R/W	20160	4EC0	OFF	
	Automatic Stop Profile	%	0 to 100	R/W	20608	5080	50	
	Automatic End Stop	toggle	OFF / ON	R/W	20416	4FC0	OFF	
	Automatic Impact Load	toggle	OFF / ON	R/W	20480	5000	OFF	
	Auto Smooth Stop	toggle	OFF / ON	R/W	20224	4F00	OFF	
	Auto Smoothing Level	%	10 to 100	R/W	20672	50C0	50	
	Automatic End Start (2)	toggle	OFF / ON	R/W	19904	4DC0	OFF	
	– Automatic End Start (3)	toggle	OFF / ON	R/W	20032	4E40	OFF	
	– Rate End Start (3)	%	0 to 100	R/W	768	0300	50	
(P3) Start Settings	Start Time	s	1 to 300	R/W	7104	1BC0	10	
	Start Pedestal	%	10 to 100	R/W	704	02C0	20	
	Start Current Limit → Start Current Limit Trip	toggle	OFF / ON	R/W	53790	D21E	ON	
	Start Current Limit → Start Current Limit Level	A	100% mtr FLA to 450% STS rated A	R/W	26880	6900	350% mtr FLA	
	Start Current Limit → Start Current Limit Time	s	1 to 300	R/W	26944	6940	30	
	Kick Start → Kick Start	toggle	OFF / ON	R/W	320	0140	OFF	
	Kick Start → Kick Start Time	ms	10 to 2,000	R/W	7040	1B80	100	
	Kick Start → Kick Start Pedestal	%	30 to 80	R/W	640	0280	75	
	Contactor Delay	ms	20 to 800	R/W	8320	2080	160	
(P4) Stop Settings	Stop Time	s	0 to 300	R/W	7296	1C80	0	
	Stop Pedestal	%	10 to 40	R/W	896	0380	10	
	Stop Current Limit → Stop Current Limit Trip	toggle	OFF / ON	R/W	53791	D21F	OFF	
	Stop Current Limit → Stop Current Limit Level	A	100% mtr FLA to 450% STS rated A	R/W	28800	7080	350% mtr FLA	
	Stop Current Limit → Stop Current Limit Time	s	1 to 300	R/W	28864	70C0	10	

3. Configuration and Parameters (continued)

3.7.1 Summary – Parameters for Touchscreen Setup – "Advanced" Category (continued)

–	Group	Parameter	Units	Range	Read / Write	Modbus		Default Setting	User Settin
						Dec	Hex		
	(P5) Motor Protection]	Motor Current	A	50% to 100% of STS rated A	R/W	25728	6480	100%	
		Trip Class	class	10, 20, 30	R/W	25664	6440	10	
		Low Current Settings → Low Current Trip	toggle	OFF / ON	R/W	53787	D21B	OFF	
		Low Current Settings → Low Current Trip Level	A	25% to 100% of motor FLA	R/W	26304	66C0	25%	
		Low Current Settings → Low Current Trip Time	ms	100 to 9,000	R/W	26368	6700	100	
		Shearpin Settings → Shearpin Trip	toggle	OFF / ON	R/W	53793	D221	ON	
		Shearpin Settings → Shearpin Trip Current	A	100% mtr FLA to 450% STS rated A	R/W	27584	6BC0	450% STS A	
		Shearpin Settings → Shearpin Trip Time	ms	100 to 9,000	R/W	27648	6C00	100	
		Overload Settings → Overload Trip	toggle	OFF / ON	R/W	53792	D220	ON	
		Overload Settings → Overload Level	A	50% to 125% of motor FLA	R/W	28224	6E40	115%	
	(P6) iERS	iERS	toggle	OFF / ON	R/W	21120	5280	ON	
		Dwell Time	s	1 to 300	R/W	7360	1CC0	5	
		iERS Rate	%	0 to 100	R/W	21184	52C0	25	
		iERS Level	%	0 to 100	R/W	21376	5380	100	
		Fixed Voltage (Level)	V	100 to 500	R/W	35200	8980	500	
		Fixed Voltage	toggle	OFF / ON	R/W	35264	89C0	OFF	
	(P7) Control	Control Method	–	Local Touch Screen User Programmable Two Wire Control Three Wire Control Modbus Network	R/W	59392	E800	Local Touch Screen	

3. Configuration and Parameters (continued)

3.7.1 Summary – Parameters for Touchscreen Setup – "Advanced" Category (continued)									
–	Group	Parameter	Units	Range	Read / Write	Modbus		Default Setting	User Setting
						Dec	Hex		
	(P8) Trip Settings	Trip Sensitivity	%	0 to 100	R/W	44864	AF40	0	
		Cover Open Trip	toggle	OFF / ON	R/W	53803	D22B	OFF	
		Shearpin Trip	toggle	OFF / ON	R/W	53793	D221	ON	
		Overload Trip	toggle	OFF / ON	R/W	53792	D220	ON	
		Low Current Trip	toggle	OFF / ON	R/W	53787	D21B	OFF	
		Start Current Limit Trip	toggle	OFF / ON	R/W	53790	D21E	ON	
		Stop Current Limit Trip	toggle	OFF / ON	R/W	53791	D21F	OFF	
		PTC Motor Thermistor Trip	toggle	OFF / ON	R/W	53794	D222	OFF	
		L1-L2-L3 Trip	toggle	OFF / ON	R/W	53808	D230	OFF	
		L1-L3-L2 Trip	toggle	OFF / ON	R/W	53807	D22F	OFF	
		Remote Start Trip	toggle	OFF / ON	R/W	53804	D22C	ON	
		Current Sensor Trip	toggle	OFF / ON	R/W	5377	D20F	OFF	
		Fan Trip	toggle	OFF / ON	R/W	53782	D216	ON	
		Communications Trip	toggle	OFF / ON	R/W	53796	D224	ON	
		Shut Down (1)	toggle	OFF / ON	R/W	53769	D209	ON	
		Shut Down (2)	toggle	OFF / ON	R/W	53770	D20A	ON	
		Thyristor Firing Trip	toggle	OFF / ON	R/W	53774	D20E	ON	
		Motor Side Phase Loss	toggle	OFF / ON	R/W	53777	D211	ON	
		Sensing Fault Trip	toggle	OFF / ON	R/W	53781	D215	ON	
		Thermal Sensor Trip	toggle	OFF / ON	R/W	53768	D208	ON	
		External Trip Enable	toggle	OFF / ON	R/W	53795	D223	OFF	
		Main Board Trip	toggle	OFF / ON	R/W	53800	D228	ON	
		Keypad Trip	toggle	OFF / ON	R/W	53798	D226	OFF	
		Logging Trip	toggle	OFF / ON	R/W	53799	D227	OFF	
		Input Side Phase Loss	toggle	OFF / ON	R/W	53762	D202	ON	
		Firing Mode	toggle	OFF / ON	R/W			In-line	
		Legacy Delta Mode	toggle	OFF / ON	R/W			OFF	

3. Configuration and Parameters (continued)

3.7.2 Summary – Parameters for Touchscreen Setup – "I/O" Category

Group	Parameter	Units	Range	Read / Write	Modbus		Default Setting	User Setting
					Dec	Hex		
Digital Inputs	Digital Input Voltage	V	230VAC, 110VAC, 24VDC	R/W	10880	2A80	230VAC	
	Control Method	–	Local Touch Screen User Programmable Two Wire Control Three Wire Control Modbus Network	R/W	59392	E800	Local Touch Screen	
	Digital Input 1 (D1-1I) → Select Function	–	Off Start / Stop Freeze Ramp Reset iERS External Trip	R/W	10944	2AC0	Start / Stop	
	Digital Input 1 (D1-1I) → High Input =1 Sets Value	toggle	OFF / ON	R/W	11264	2C00	ON	
	Digital Input 2 (D1-2I) → Select Function	–	same as DI1 function selections	R/W	10945	2AC1	OFF	
	Digital Input 2 (D1-2I) → High Input =1 Sets Value	toggle	OFF / ON	R/W	11266	2C02	ON	
	Digital Input 3 (D2-1I) → Select Function	–	same as DI1 function selections	R/W	10946	2AC2	Reset	
	Digital Input 3 (D2-1I) → High Input =1 Sets Value	toggle	OFF / ON	R/W	11268	2C04	ON	
Digital Outputs	Digital Output 1 N/C (12) → Select Function	–	Off Ready Enabled Error Running End Of Start Current Limit iERS Active	R/W	11584	2D40	Error	
	Digital Output 1 N/C (12) → High Output =1 When Value	toggle	OFF / ON	R/W	11904	2E80	ON	
	Digital Output 2 N/O (24) → Select Function	–	same as DO1 function selections	R/W	11585	2D41	Error	
	Digital Output 2 N/O (24) → High Output =1 When Value	toggle	OFF / ON	R/W	11906	2E82	ON	
	Digital Output 3 N/O (34) → Select Function	–	same as DO1 function selections	R/W	11586	2D42	Run-ning	
	Digital Output 3 N/O (34) → High Output =1 When Value	toggle	OFF / ON	R/W	11908	2E84	ON	
	Digital Output 4 N/O (44) → Select Function	–	same as DO1 function selections	R/W	11587	2D43	End Of Start	
	Digital Output 4 N/O (44) → High Output =1 When Value	toggle	OFF / ON	R/W	11910	2E86	ON	
Analog Inputs	Analog Input Type	toggle	0–10V / 4–20mA	R/W	9600	2580	0–10V	
	Select Function	–	Off Current Limit Start Current Shearpin Current Overload	R/W	9664	25C0	OFF	
	Scaling Level	–	0 to 16,384	R/W	9728	2600	16,384	

3. Configuration and Parameters (continued)

3.7.2 Parameter Summary for Touchscreen Setup – "I/O" Category (continued)									
–	Group	Parameter	Units	Range	Read / Write	Modbus		Default Setting	User Setting
						Dec	Hex		
	Analog Outputs	Analog Output Type	toggle	0–10V / 4–20mA	R/W	8960	2300	0–10V	
		Select Function	–	Off Current Measured Overload Overload SCR	R/W	9024	2340	OFF	
		Scaling Level	–	0 to 16,384	R/W	9088	2380	0	
		PTC Motor Thermistor Trip	toggle	OFF / ON	R/W	53794	D222	OFF	

3.7.3 Summary – Parameters for Touchscreen Setup – "Monitor" Category									
	Group	Parameter	Units	Range	Read / Write	Modbus		Default Setting	User Setting
						Dec	Hex		
	Monitoring	Line Frequency	Hz	45 to 65	Read	32000	7D00	n/a	–
		Phase Rotation	–	L1-L2-L3 or L1-L3-L2	Read	32064	7D40	L1-L2-L3	–
		I1	A	0 to 10,000	Read	33536	8300	0	–
		I2	A	0 to 10,000	Read	33538	8302	0	–
		I3	A	0 to 10,000	Read	33540	8304	0	–
		Current I rms	A	0 to 10,000	Read	32896	8080	0	–
		V rms (Approx)	V	0 to 500	Read	32960	80C0	0	–
		Real Power Factor	–	0 to 1	Read	33024	8100	0	–
		True Power P	kW	0 to 10,000	Read	34688	8780	0	–
		Apparent Power S	kVA	0 to 10,000	Read	34816	8800	0	–
		Reactive Power Q	kVAR	0 to 10,000	Read	34944	8880	0	–
		iERS Saving Level	%	0 to 100	Read	35008	88C0	0	–
		Delay Angle	degree	0° to 55°	Read	22400	5780	0	–
		Backstop	degree	0° to 55°	Read	23040	5A00	0	–
		Delay Max	degree	0° to 55°	Read	22464	57C0	0	–
		Pres PF Degrees	degree	0° to 90°	Read	21824	5540	0	–
		Ref PF Degrees	degree	0° to 90°	Read	21760	5500	0	–
		Start Saving Level	%	50% to 80% of mtr FLA	Read	21320	5348	80%	–
		Last Peak (Start) Current	A	0 to 10,000	Read	38400	9600	0	–
		HeatSink Temp	°C	-20°C to 80°C	Read	36544	8EC0	ambient	–
		Motor Thermistor	–	0 to 1024	Read	10432	28C0	0	–
		Overload	%	0 to 100	Read	33408	8280	0	–

3. Configuration and Parameters (continued)

3.7.4 Summary – Parameters for Touchscreen Setup – "Log" Category

Group	Parameter	Units	Range	Read / Write	Modbus		Default Setting	User Setting
Event Times for Last Peak Start Currents, Last Temperatures, Last Overloads	(Event Time) Last Peak Start Current / Last Temperature / Last Overload	hh : mm : ss	Time since midnight; Days since 01/01/1984	Read	38464	9640	GMT	–
	(Event Time) Last Peak Start Current / Last Temperature / Last Overload -1			Read	38467	9643		–
	(Event Time) Last Peak Start Current / Last Temperature / Last Overload -2			Read	38470	9646		–
	(Event Time) Last Peak Start Current / Last Temperature / Last Overload -3			Read	38473	9649		–
	(Event Time) Last Peak Start Current / Last Temperature / Last Overload -4			Read	38476	964C		–
	(Event Time) Last Peak Start Current / Last Temperature / Last Overload -5			Read	38479	964F		–
	(Event Time) Last Peak Start Current / Last Temperature / Last Overload -6			Read	38482	9652		–
	(Event Time) Last Peak Start Current / Last Temperature / Last Overload -7			Read	38485	9655		–
	(Event Time) Last Peak Start Current / Last Temperature / Last Overload -8			Read	38488	9658		–
	(Event Time) Last Peak Start Current / Last Temperature / Last Overload -9			Read	38491	965B		–
Trip Log	Last Trip	–	0 to 65,535	Read	60608	ECC0	0	–
	Last Trip -1	–	0 to 65,535	Read	60609	ECC1	0	–
	Last Trip -2	–	0 to 65,535	Read	60610	ECC2	0	–
	Last Trip -3	–	0 to 65,535	Read	60611	ECC3	0	–
	Last Trip -4	–	0 to 65,535	Read	60612	ECC4	0	–
	Last Trip -5	–	0 to 65,535	Read	60613	ECC5	0	–
	Last Trip -6	–	0 to 65,535	Read	60614	ECC6	0	–
	Last Trip -7	–	0 to 65,535	Read	60615	ECC7	0	–
	Last Trip -8	–	0 to 65,535	Read	60616	ECC8	0	–
	Last Trip -9	–	0 to 65,535	Read	60617	ECC9	0	–
Start Current Log	Last Peak (Start) Current	A	0 to 10,000	Read	38400	9600	0	–
	Last Peak Start Current -1	A	0 to 10,000	Read	38402	9602	0	–
	Last Peak Start Current -2	A	0 to 10,000	Read	38404	9604	0	–
	Last Peak Start Current -3	A	0 to 10,000	Read	38406	9606	0	–
	Last Peak Start Current -4	A	0 to 10,000	Read	38408	9608	0	–
	Last Peak Start Current -5	A	0 to 10,000	Read	38410	960A	0	–
	Last Peak Start Current -6	A	0 to 10,000	Read	38412	960C	0	–
	Last Peak Start Current -7	A	0 to 10,000	Read	38414	960E	0	–
	Last Peak Start Current -8	A	0 to 10,000	Read	38416	9610	0	–

3. Configuration and Parameters (continued)

3.7.4 Summary – Parameters for Touchscreen Setup – "Log" Category (continued)									
–	Group	Parameter	Units	Range	Read / Write	Modbus		Default Setting	User Setting
						Dec	Hex		
	Stop Current Log	Last Peak Stop Current	A	0 to 10,000	Read	39040	9880	0	–
		Last Peak Stop Current -1	A	0 to 10,000	Read	39042	9882	0	–
		Last Peak Stop Current -2	A	0 to 10,000	Read	39044	9884	0	–
		Last Peak Stop Current -3	A	0 to 10,000	Read	39046	9886	0	–
		Last Peak Stop Current -4	A	0 to 10,000	Read	39048	9888	0	–
		Last Peak Stop Current -5	A	0 to 10,000	Read	39050	988A	0	–
		Last Peak Stop Current -6	A	0 to 10,000	Read	39052	988C	0	–
		Last Peak Stop Current -7	A	0 to 10,000	Read	39054	988E	0	–
		Last Peak Stop Current -8	A	0 to 10,000	Read	39056	9890	0	–
		Last Peak Stop Current -9	A	0 to 10,000	Read	39058	9892	0	–
	Temperature Log	Last Temperature	°C	-20°C to 80°C	Read	39680	9B00	ambient	–
		Last Temperature -1	°C	-20°C to 80°C	Read	39681	9B01	ambient	–
		Last Temperature -2	°C	-20°C to 80°C	Read	39682	9B02	ambient	–
		Last Temperature -3	°C	-20°C to 80°C	Read	39683	9B03	ambient	–
		Last Temperature -4	°C	-20°C to 80°C	Read	39684	9B04	ambient	–
		Last Temperature -5	°C	-20°C to 80°C	Read	39685	9B05	ambient	–
		Last Temperature -6	°C	-20°C to 80°C	Read	39686	9B06	ambient	–
		Last Temperature -7	°C	-20°C to 80°C	Read	39687	9B07	ambient	–
		Last Temperature -8	°C	-20°C to 80°C	Read	39688	9B08	ambient	–
		Last Temperature -9	°C	-20°C to 80°C	Read	39689	9B09	ambient	–
	Overload Log	Last Overload	%	0 to 100	Read	40320	9D80	0	–
		Last Overload -1	%	0 to 100	Read	40321	9D81	0	–
		Last Overload -2	%	0 to 100	Read	40322	9D82	0	–
		Last Overload -3	%	0 to 100	Read	40323	9D83	0	–
		Last Overload -4	%	0 to 100	Read	40324	9D84	0	–
		Last Overload -5	%	0 to 100	Read	40325	9D85	0	–
		Last Overload -6	%	0 to 100	Read	40326	9D86	0	–
		Last Overload -7	%	0 to 100	Read	40327	9D87	0	–
		Last Overload -8	%	0 to 100	Read	40328	9D88	0	–
		Last Overload -9	%	0 to 100	Read	40329	9D89	0	–
	Totals Log	Number of Starts	–	0 to 4,294,836,225	Read	35840	8C00	0	–
		Download Log File	–	–	R/W	n/a	n/a	–	
		Clear Trip Log	–	–	R/W	n/a	n/a	–	

3. Configuration and Parameters (continued)

3.7.5 Summary–Parameters forTouchscreenSetup–"Device"Category

Group	Parameter	Units	Range	Read / Dec	Modbus		Default Setting	User Setting
					Dec	Hex		
(P25)	Update Firmware	–	–	R/W	–	–	–	
	Date	–	current date	R/W	–	–	–	
	Time	hh:mm:ss	GMT / local	R/W	14720	3980	GMT	
	Language	–	refer to the "Parameter Details" section for list of available languages	R/W	13376	3440	English	
	Passcode	–	0 to 255 per Byte	R/W	12864 12865 12866 12867	3240 3241 3242 3243	n/a	
	Backlight Timeout	s	0 to 3,600	R/W	14208	3780	60	
(P26) Networks	Modbus Network Address	–	1 to 32	R/W	16000	3E80	1	
	Modbus Network Baud Rate	Baud	9,600 19,200 38,400 57,600 115,200	R/W	16064	3EC0	19,200	
	Modbus Network Parity	–	none / odd / even	R/W	16128	3F00	even	
	Modbus Network Traffic LEDs	toggle	OFF / ON	R/W	14080	3700	OFF	
	Anybus / ModbusTCP / EtherNetIP	–	Address Serial Number Firmware Version Connection	Read	–	–	–	–
	Timeout	ms	0 to 60,000	R/W	15808	3DC0	5,000	
(P27)	Reset Defaults	–	Yes / No	R/W	62080	F280	No	
	About	–	STS model #, serial #, software versions	Read	–	–	–	–
	Screen Lock	toggle	OFF / ON	R/W	12992	32C0	OFF	
	Date Format	–	dd/mm/yyyy mm/dd/yyyy	R/W	13248	33C0	dd/mm/yyyy	
	Temperature Format	degrees	°C / °F	R/W	13312	3400	°C	
	Parameters to USB		Yes / No	R/W	62272	F340	No	
	Parameters from USB		Yes / No	R/W	62336	F380	No	
	Service Code	for manufacturer's use only			13120	3340		

3. Configuration and Parameters (continued)

3.8 Auto-Setup Menu

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 19200 **Auto Setup** ↓ ↓ **Application:**	The Unit has numerous preset applications built in as standard. Select the application best suited to the load. The selected application will automatically change several parameters and functions. Depending on the application loaded the "Trip Class" may also change Refer to the separate 'applications section' for more details	Default	End of list	Default		Read/Write
PNU 25664 **Auto Setup** ↓ ↓ **Trip Class**	The trip class is a numeric value that correlates the trip time with overload level. Select Trip class according to application requirements The trip time depends on the selected Trip Class. The duration of the overload and the level of the over current. Refer to the Motor Overload 'cold' trip curves given in the Quick Start Guide. When "Class 20" or "Class30" are selected the Unit current rating (i-Unit) will be reduced to a lower value (i-rated).	Trip Class 10	Trip Class 30	Trip Class 10		Read/Write

3. Configuration and Parameters (continued)

3.8 Auto-Setup Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 25728 **Auto Setup** ↓ ↓ **Motor Current**	This should be set to the Full Load Current shown on the motor plate The overload works with multiples of the set "Motor Current" (i-motor) Also referred to as Motor FLA	50% I-rated	100% I-rated	100% I-rated	A	Read/Write
PNU 59392 ***Auto Setup*** ↓ ↓ **Control Method**	**Local Touch Screen** : Control using the button on the keypad **User Programmable** : Control using the terminals. Function defined in "I/O" menu **Two Wire Control** : Control using terminals. Functions fixed as shown on screen **Three Wire Control** : Control using terminals. Functions fixed as shown on screen **Modbus Network** : Control via remote Modbus network or remote Keypad or Modbus TCP	Local Touch Screen	Modbus Network	Local Touch Screen		Read/Write
PNU 10880 **Auto Setup** ↓ ↓ **Digital Input Voltage**	The digital inputs D1-1I D1-2I D2-1I are designed to work with a range of control supplies 230V : 'Active high level' Input voltage must be in the range 195.5V - 253V 110V : 'Active high level' Input voltage must be in the range 93.5V - 121V 24V : 'Active high level ' input voltage must be in the range 20.4V-26.4V ⚠ It is important to ensure the "Digital input Voltage" corresponds to the voltage applied to the input.	230V	24VDC	230V		Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 19840 **Advanced** **Automatic Settings** ↓ **Automatic Pedestal**	Automatically controls the starting torque On : The initial torque is increased until the motor starts to rotate at a moderate speed. Off: The initial torque is defined by the "Start Pedestal"	Off	On	Off		Read/Write
PNU 20352 **Advanced** **Automatic Settings** ↓ **Automatic Ramp**	Automatically controls the torque applied to the motor during the soft start. On : The torque is adjusted to suit the load. Off: The ramp time depends on the "Start Time" and "Current Limit"	Off	On	Off		Read/Write
PNU 19968 **Advanced** **Automatic Settings** ↓ **Automatic End Start (1)**	Automatically controls the time taken for the motor to start On : The ramp time is shortened if the motor is at speed before the end of the "Start Time" Off: The ramp time depends on the "Start Time" and "Current Limit"	Off	On	Off		Read/Write
PNU 20160 **Advanced** **Automatic Settings** ↓ **Automatic Stop**	Automatically controls the soft stop to suit the application. This feature is particularly useful with pumping applications On : If the motor is lightly loaded it decelerates rapidly to the point where the soft stop becomes useful. Off : The deceleration to the point where the soft stop becomes useful, will be slower.	Off	On	Off		Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 20416 **Advanced** **Automatic Settings** ↓ **Automatic End Stop**	Automatically controls the "Stop Time" On : The ramp time is shortened if the motor reaches a very low speed before the end of the "Stop Time" Off: The ramp time " depends on the "Stop Time" and "Current Limit"	Off	On	Off		Read/Write
PNU 20480 **Advanced** **Automatic Settings** ↓ **Automatic Impact Load**	Automatically controls the maximum iERS saving level. On : The maximum iERS saving level ("BackStop") is reset to maximum during each load cycle. Off : The saving potential may be reduced on applications with heavy load cycles. Such as injection moulding machines.	Off	On	Off		Read/Write
PNU 20224 **Advanced** **Automatic Settings** ↓ **Auto Smooth Stop**	Automatically controls the soft stop to eliminate oscillations that can occur towards the end of the ramp On : The soft stop is adjusted when oscillations are detected. Refer to "Auto smoothing Level" Off : The soft stop is unadjusted and torque fluctuations may cause instability. This can often occur in pumping applications	Off	On	Ofqf		Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 20672 **Advanced** **Automatic Settings** ↓ **Auto Smoothing Level**	Adjusts the response of the "Automatic smoothing" Increase to provide a greater smoothing effect If there are torque fluctuations that occur during the soft stop. When set to zero the smoothing is effectively disabled.	10	100	50	%	Read/Write
PNU 19904 **Advanced** **Automatic Settings** ↓ **Automatic End Start (2)**	Automatically controls the time taken for the motor to start On : The ramp time is shortened if the motor current falls below the current limit level before the end of the "Start Time". Off: The ramp time depends on the "Start Time" and "Current Limit"	Off	On	Off		Read/Write
PNU 20032 **Advanced** **Automatic Settings** ↓ **Automatic End Start (3)**	Automatically controls the time taken for the motor to start On : The ramp time is shortened if torque fluctuations occur before the end of the "Start Time" Off: The ramp time depends on the "Start Time" and "Current Limit"	Off	On	Off		Read/Write
PNU 768 **Advanced** **Automatic Settings** ↓ **Rate End Start (3)**	Adjusts the response of the "Automatic End Start (3)" Increase to provide a greater smoothing effect If there are torque fluctuations that occur during the soft start. When set to zero the smoothing is effectively disabled.	0	100	50	%	Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 704 **Advanced** **Start Settings** ↓ **Start Pedestal**	Percentage of the supply voltage applied to motor at the beginning of the soft start. Increase to provide more torque If the load fails to break away. Decrease if the motor accelerates too quickly.	10	100	20	%	Read/Write
PNU 53790 **Advanced** **Start Settings** **Start Current Limit** **Start Current Limit Trip**	Selects trip or continue if the current limit has been active for too long On : The Unit will trip Off: The start will continue regardless of the motor current level	Off	On	On		Read/Write
PNU 26880 **Advanced** **Start Settings** **Start Current Limit** **Start Current Limit Level**	The current in Amps at which the soft Start ramp is held. Normally set to 350% of motor FLC. Increase if motor fails to accelerate at required rate The "Current Limit Level" will effect actual time to start. If set too low the motor may not accelerate to full speed.	50% I-motor	450% I-STS	350% I-motor	A	Read/Write
PNU 26944 **Advanced** **Start Settings** **Start Current Limit** **Start Current Limit Time**	The maximum time allowed for the current limit. If the current limit is still active at the end of this period the Unit will either 'Trip' or 'continue'	1	600	30	s	Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 7040 **Advanced** **Start Settings** **Kick Start** **Kick Start Time**	Time that the torque pulse is applied to load Increase to provide more torque If the load fails to break away. Decrease if the motor accelerates too quickly.	10	2000	100	ms	Read/Write
PNU 640 **Advanced** **Start Settings** **Kick Start** **Kick Start Pedestal**	Percentage of the supply voltage applied to the motor during the 'kick' period Increase to provide more torque If the load fails to break away. Decrease if the motor accelerates too quickly.	30	80	75	%	Read/Write
PNU 8320 **Advanced** **Start Settings** ↓ **Contactor Delay**	Time allowed for external contactors to close. Increase if contactors are driven by buffer relays or motor trips on phase loss when start signal applied Decrease if response to start signal needs to be improved	20	800	160	ms	Read/Write
PNU 7296 **Advanced** **Stop Settings** ↓ **Stop Time**	The time taken to soft stop from full voltage or the iERS level to the 'Stop Pedestal' Normally set between 15 and 60 seconds. Actual time to get to 'Stop Pedestal' depends on the "Stop Current Limit Level". If set too long the motor may reach zero speed before the end of the time set. Refer to "Automatic End Stop"	0	300	0	s	Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 896 **Advanced** **Stop Settings** ↓ **Stop Pedestal**	Percentage of the supply voltage applied to the motor at the end of the soft stop Increase if the motor crawls at the end of the soft stop. Decrease if a greater soft-stop effect is required at the end of the ramp.	10	40	10	%	Read/Write
PNU 53791 **Advanced** **Stop Settings** **Stop Current Limit** **Stop Current Limit Trip**	Selects trip or continue if the stop current limit has been active for too long On : The Unit will trip Off: The stop will continue regardless of the motor current level	Off	On	Off		Read/Write
PNU 28800 **Advanced** **Stop Settings** **Stop Current Limit** **Stop Current Limit Level**	The current in Amps at which the soft stop ramp is not allowed to go above. Normally set to 350% motor FLC. Increase if motor decelerates too rapidly. The current limit level will effect actual time to stop the motor.	100% I-motor	450% I-STS	350% I-motor	A	Read/Write
PNU 28864 **Advanced** **Stop Settings** **Stop Current Limit** **Stop Current Limit Time**	The maximum time allowed for the current limit. If the current limit is still active at the end of this period the Unit will either trip or continue	1	300	10	s	Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 25664 **Advanced** **Motor Protection** ↓ **Trip Class**	The trip class is a numeric value that correlates the trip time with overload level. Select Trip class according to application requirements The trip time depends on the selected Trip Class. The duration of the overload and the level of the over current. Refer to the Motor Overload 'cold' trip curves given in the Quick Start Guide. When "Class 20" or "Class30" are selected the Unit current rating (i-Unit) will be reduced to a lower value (i-rated).	Trip Class 10	Trip Class 30	Trip Class 10		Read/Write
PNU 53787 **Advanced** **Motor Protection** **Low Current Settings** **Low Current Trip**	This can be used to detect if the motor is running lightly loaded. On : The Unit will trip. This feature is not active during soft start and soft stop. Off: The Unit will continue to operate regardless of motor current	Off	On	Off		Read/Write
PNU 26304 **Advanced** **Motor Protection** **Low Current Settings** **Low Current Trip Level**	The current in Amps that will cause a trip A trip will occur if the motor current is less than the "Trip Level" for the "Trip Time"	25% I-motor	100% I-motor	25% I-motor	A	Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 26368 **Advanced** **Motor Protection** **Low Current Settings** **Low Current Trip Time**	The trip time for the Low current trip A trip will occur if the motor current is less than the "Trip Level" for the "Trip Time"	100	9000	100	ms	Read/Write
PNU 53793 **Advanced** **Motor Protection** **Shearpin Settings** **Shearpin Trip**	The shearpin is an electronic equivalent of a mechanical shearpin On : The Unit will trip. This feature is not active during soft start and soft stop. Off: The Unit will continue to operate regardless of motor current level	Off	On	On		Read/Write
PNU 27584 **Advanced** **Motor Protection** **Shearpin Settings** **Shearpin Trip Current**	The current in Amps that will cause a "Shearpin Trip" A trip will occur if the motor current is greater than the "Trip Level" for the "Trip Time"	100% I-motor	450% I-STS	450% I-STS	A	Read/Write
PNU 27648 **Advanced** **Motor Protection** **Shearpin Settings** **Shearpin Trip Time**	The trip time for the Shearpin trip A trip will occur if the motor current is greater than the "Trip Level" for the "Trip Time"	100	9000	100	ms	Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 53792 **Advanced** **Motor Protection** **Overload Settings** **Overload Trip**	The Unit has an "Overload" function that is an electronic equivalent to a thermal overload. On : The Unit will trip when the "Overload" capacity (ModbusPNU 33408) exceeds 100% Off: The Unit will continue to operate regardless of motor current level. *Not recommended*	Off	On	On		Read/Write
PNU 28224 **Advanced** **Motor Protection** **Overload Settings** **Overload Level**	Determines the level in Amps at which the overload will start. Normally set to 115% of the set motor current (i-motor) Reduce to speed up trip response	50% I-motor	125% I-motor	115% I-motor	A	Read/Write
PNU 21120 **Advanced** **iERS** ↓ **iERS**	Enables and disables the intelligent Energy Recovery System feature (iERS). On : The voltage to the motor will be regulated to ensure optimum efficiency. Off : The feature is disabled and the motor operates at full voltage. Internal bypass closed	Off	On	On		Read/Write
PNU 7360 **Advanced** **iERS** ↓ **Dwell Time**	The time from the End of the start to the point where the iERS saving mode becomes active. Normally set to 5 seconds to ensure the motor is at full speed before the iERS saving becomes active Increase to allow time for the motor to stabilise.	1	300	5	s	Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 21184 **Advanced** **iERS** ↓ **iERS Rate**	Determines the rate at which the load is regulated during the iERS energy saving mode During periods of instability the "Current Irms" and "True Power Factor" will oscillate rapidly. Increase if the applications shows signs of instability. Reduce to increase the speed of response	0	100	25	%	Read/Write
PNU 21376 **Advanced** **iERS** ↓ **iERS Level**	Determines the maximum energy saving potential. Reduce if the application shows signs of instability. The amount of energy that can be saved may fall as the "iERS level" is reduced.	0	100	100	%	Read/Write
PNU 35200 **Advanced** **iERS** ↓ **Fixed Voltage**	User settable voltage level for power calculations Use to improve accuracy of power calculations	100	500	100	V	Read/Write
PNU 35264 **Advanced** **iERS** ↓ **Fixed Voltage**	Selects the source for the voltage value used in the power calculations. on: KW KVar and KVA are calculated using the "Fixed Voltage" off: KW KVar and KVA are calculated using the internally measured voltage.	Off	On	Off		Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 59392 **Advanced** ↓ ↓ **Control Method**	Local Touch Screen : Control using the button on the keypad User Programmable : Control using the terminals. Function defined in "I/O" menu Two Wire Control : Control using terminals. Functions fixed as shown on screen Three Wire Control : Control using terminals. Functions fixed as shown on screen Modbus Network : Control via remote Modbus network or remote Keypad or Modbus TCP	Local Touch Screen	Modbus Network	Local Touch Screen		Read/Write
PNU 44864 **Advanced** **Trip Settings** ↓ **Trip Sensitivity**	Adjusts the reaction time to fault trips Increase "Trip Sensitivity" to slow the response to fault trips. Sometimes useful on sites were electrical noise is causing nuisance tripping This is a global setting. Increasing "Trip Sensitivity" will slow the response of all the trips.	0	100	0	%	Read/Write
PNU 53803 **Advanced** **Trip Settings** ↓ **Cover Open Trip**	For safety purposes the Unit has been designed to trip if the front cover is open On : The Unit will trip if the front cover is open. This trip is active at all times. Off : The Unit will continue to operate with the cover open	Off	On	Off		Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 53793 **Advanced** **Trip Settings** ↓ **Shearpin Trip**	The shearpin is an electronic equivalent of a mechanical shearpin On : The Unit will trip. This feature is not active during soft start and soft stop. Off: The Unit will continue to operate regardless of motor current level	Off	On	On		Read/Write
PNU 53792 **Advanced** **Trip Settings** ↓ **Overload Trip**	The Unit has an "Overload" function that is an electronic equivalent to a thermal overload. On : The Unit will trip when the "Overload" capacity (ModbusPNU 33408) exceeds 100% Off: The Unit will continue to operate regardless of motor current level	Off	On	On		Read/Write
PNU 53787 **Advanced** **Trip Settings** ↓ **Low Current Trip**	This can be used to detect if the motor is running lightly loaded. On : The Unit will trip. This feature is not active during soft start and soft stop. Off: The Unit will continue to operate regardless of motor current	Off	On	Off		Read/Write
PNU 53790 **Advanced** **Trip Settings** ↓ **Start Current Limit Trip**	Selects trip or continue if the current limit has been active for too long On : The Unit will trip Off: The start will continue regardless of the motor current level	Off	On	On		Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 53791 **Advanced** **Trip Settings** ↓ **Stop Current Limit Trip**	Selects trip or continue if the stop current limit has been active for too long On : The Unit will trip Off: The stop will continue regardless of the motor current level	Off	On	Off		Read/Write
PNU 53794 **Advanced** **Trip Settings** ↓ **PTC Motor Thermistor Trip**	A single PTC motor thermistor or set of PTC motor thermistors can be connected to the PTC terminals. On :The Unit will trip if the motor thermistor exceed its response temperature or the PTC input is open circuit Off : The unit will not trip regardless of motor rotation	Off	On	Off		Read/Write
PNU 53808 **Advanced** **Trip Settings** ↓ **L1-L2-L3 Trip**	Determines if supply phase sequence is incorrect for motor rotation On : Trips if the phase sequence is L1-L2-L3. Off : The unit will not trip regardless of motor rotation	Off	On	Off		Read/Write
PNU 53807 **Advanced** **Trip Settings** ↓ **L1-L3-L2 Trip**	Determines if supply phase sequence is incorrect for motor rotation On : Trips if the phase sequence is L1-L3-L2. Off : The unit will not trip regardless of motor rotation	Off	On	Off		Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 53804 **Advanced** **Trip Settings** ↓ **Remote Start Trip**	For safety reasons the Unit will trip during some operations if the remote start signal is active On : Trips if the remote start signal is active when the Unit is powered up or a reset is applied. Off : The Unit will not trip and may start unexpectedly if the start signal is accidently left active.	Off	On	On		Read/Write
PNU 53775 **Advanced** **Trip Settings** ↓ **Current Sensor Trip**	Detects if the internal current sensors have failed or reading a very low level. On : The Unit will trip if the internal current sensors fail or the current measured falls to a very low level Off : Will continue to operate even if the sensor has failed. Measurements and overload protection may be effected	Off	On	Off		Read/Write
PNU 53782 **Advanced** **Trip Settings** ↓ **Fan Trip**	Detects if the cooling fans have failed. On : The Unit trips if the cooling fans fitted to the Unit fail. Off : Will continue to operate and is likely to trip on a thermal trip as the heatsink will not be sufficiently cooled	Off	On	On		Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 53796 **Advanced** **Trip Settings** ↓ **Communications Trip**	Detects if the communications bus has failed or become inactive. To keep the bus active there must be at least one Modbus read or write (any PNU) during the "Timeout ms" period (ModbusPNU 15808) On :Communication trip enabled. Off : Communication trip disabled.	Off	On	On		Read/Write
PNU 53769 **Advanced** **Trip Settings** ↓ **Shut Down (1)**	This features controls the soft stop improve stability On : The stop time is truncated if the motor experiences severe torque fluctuations during the soft stop Off : Follows normal soft stop time	Off	On	On		Read/Write
PNU 53770 **Advanced** **Trip Settings** ↓ **Shut Down (2)**	This features controls the soft stop improve stability On : The stop time is truncated if the motor experiences severe torque fluctuations during the soft stop Off : Follows normal soft stop time	Off	On	On		Read/Write

The Shut Down Trips are in operation during the soft stop ramp.
At the end of the soft stop ramp, occasionally the motor can become unstable due to torque fluctuations.
If the torque fluctuations get too bad then STS may trip, this could cause issues with the restart. With Shut Down Trips turned on, if the torque fluctuations are experienced STS℠ will automatically stop the soft stop ramp and let the motor coast to a full stop. This stops STS™ tripping and allows for a restart without resetting a trip. This is normally only for a very small time due to torque fluctuations occurring at the end of a soft stop ramp. If a Shut Down occurs, then it is logged in the log file but will not affect the operation of STS™. Both shut down trips have to do with rapid changes in power factor. Soft stop smoothing will keep shut down trips from happening.

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 53774 **Advanced** **Trip Settings** ↓ **Thyristor Firing Trip**	Detects if there is a fault with one or more of the internal Thyristors or bypass relays On : Trips if one or more of the Thyristors / bypass relays has failed short circuit. ISOLATE SUPPLY. Check by measuring the resistance between L1 -T1 L2 -T2 L3 -T3 (Anything < 10R is assumed short circuit) Off (not recommended): The Unit will attempt to start and run although the operation may be erratic. Operating in this mode for prolonged periods may result in SCR failure	Off	On	On		Read/Write
PNU 53777 **Advanced** **Trip Settings** ↓ **Motor Side Phase Loss**	Detects if there is a disconnection between the Unit output and the motor On : Trips if there is a disconnection between the output side of the Unit and the motor Off : The Unit will attempt to start and run although the operation may be erratic. Operating in this mode for prolonged periods may result in SCR failure	Off	On	On		Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 53781 **Advanced** **Trip Settings** ↓ **Sensing Fault Trip**	Detects if there is a fault with operation of one or more of the internal Thyristors On : Trips if one or more of the Thyristors fails to turn on properly. Off : The Unit will attempt to start and run although the operation may be erratic. Operating in this mode for prolonged periods may result in SCR failure	Off	On	On		Read/Write
PNU 53768 **Advanced** **Trip Settings** ↓ **Thermal Sensor Trip**	Detects if the internal temperature sensor has malfunctioned On : The Unit will trip if the internal temperature sensor malfunctions Off : The Unit will continue to operate even if the temperature sensor has malfunctioned. Operating in this mode for prolonged periods may result in SCR failure	Off	On	On		Read/Write
PNU 53795 **Advanced** **Trip Settings** ↓ **External Trip**	Allows a trip to be forced using one of the digital inputs On : Trips when the programmed input is active Off : External Trip is disabled	Off	On	On		Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 53800 **Advanced** **Trip Settings** ↓ **Operation 3 Trip**	Detects if the Control Board has failed to operate normally On : Operation 3 trip enabled. Off : Operation 3 trip disabled.	Off	On	On		Read/Write
PNU 53798 **Advanced** **Trip Settings** ↓ **Operation 1 Trip**	Detects if the keypad Board has failed to operate normally On : Operation 1 trip enabled. Off : Operation 1 trip disabled.	Off	On	Off		Read/Write
PNU 53799 **Advanced** **Trip Settings** ↓ **Operation 2 Trip**	Detects if the logging function has failed to operate normally On : Operation 2 trip enabled. Off : Operation 2 trip disabled.	Off	On	Off		Read/Write
PNU 53762 **Advanced** **Trip Settings** ↓ **Input Side Phase Loss**	Detects if there is a disconnection between the Unit input and the supply when the motor is running. On : Trips if there is a disconnection between the input side of the Unit and the supply when the motor is running. Off : The Unit will attempt to run although the operation may be erratic. Operating in this mode for prolonged periods may result in SCR failure	Off	On	On		Read/Write

3. Configuration and Parameters (continued)

3.9 Advanced Menu (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 128 **Advanced** ↓ ↓ **Firing Mode**	Set to correspond with Unit connection to the Motor. Refer to connection diagrams in the Quick Start Guide. In-Line : The Unit is connected in-line with a delta or star connected motor. In-Delta : The Unit is connected inside the Delta of the motor. The iERS function is disabled	In-Line	In-Delta	In-Line		Read/Write
PNU 192 **Advanced** ↓ ↓ **Legacy Delta Mode**	Allows the Unit to be retro-fitted into "Delta" applications that previously used QFE / XFE (5MC) On : Operates in QFE / XFE (5MC) delta compatibility mode. Off : Operates normally. Refer to Unit Delta connection diagram in the Quick Start Guide.	Off	On	Off		Read/Write
PNU 14144 **Advanced** ↓ ↓ **Main Contactor Control**	The unit is configured to start and stop when the main contactor opens and closes. On : When a zero stop time is set some faults will be ignored when main conatctor opens Off : The unit may trip when the main contcator opens	Off	On	Off		Read/Write

3. Configuration and Parameters (continued)

3.10 Input / Output

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 10880 **I/O** **Digital Inputs** ↓ **Digital Input Voltage**	The digital inputs D1-1I D1-2I D2-1I are designed to work with a range of control supplies 230V : 'Active high level' Input voltage must be in the range 195.5V - 253V 110V : 'Active high level' Input voltage must be in the range 93.5V - 121V 24V : 'Active high level ' input voltage must be in the range 20.4V-26.4V It is important to ensure the "Digital input Voltage" corresponds to the voltage applied to the input. Failure to do so may result in damage.	230V	24VDC	230V		Read/Write
59392 **I/O** **Digital Inputs** ↓ **Control Method**	Local Touch Screen : Control using the button on the keypad User Programmable : Control using the terminals. Function defined in "I/O" menu Two Wire Control : Control using terminals. Functions fixed as shown on screen Three Wire Control : Control using terminals. Functions fixed as shown on screen Modbus Network : Control via remote Modbus network or remote Keypad or Modbus TCP	Local Touch Screen	Modbus Network	Local Touch Screen		Read/Write
PNU 10944 **I/O** **Digital Inputs** **Digital Input 1 (D1-1I)** **Select Function**	Allows the Digital input (D1-1I) to be mapped to different functions The selected function will change in proportion with the input Digital inputs can only be mapped if the "Control Method" is set to "User Programmable"	Off	End of list	Start/Stop		Read/Write

3. Configuration and Parameters (continued)

3.10 Input / Output (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 10945 **I/O** **Digital Inputs** **Digital Input 2 (D1-2I)** **Select Function**	Allows the Digital input (D1-2I) to be mapped to different functions The selected function will change in proportion with the input Digital inputs can only be mapped if the "Control Method" is set to "User Programmable"	Off	End of list	Off		Read/Write
PNU 11266 **I/O** **Digital Inputs** **Digital Input 2 (D1-2I)** **High Input = 1 Sets Value**	Allows the polarity of the input to be reversed On : When the input is on the selected function will be on. Off : When the input is off the selected function will be on.	Off	On	On		Read/Write
PNU 10946 **I/O** **Digital Inputs** **Digital Input 3 (D2-1I)** **Select Function**	Allows the Digital input (D2-1I) to be mapped to different functions The selected function will change in proportion with the input Digital inputs can only be mapped if the "Control Method" is set to "User Programmable"	Off	End of list	Reset		Read/Write
PNU 11268 **I/O** **Digital Inputs** **Digital Input 3 (D2-1I)** **High Input = 1 Sets Value**	Allows the polarity of the input to be reversed On : When the input is on the selected function will be on. Off : When the input is off the selected function will be on.	Off	On	On		Read/Write

3. Configuration and Parameters (continued)

3.10 Input / Output (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 11584 **I/O** **Digital Outputs** **Digital Output 1 N/C(12)** **Select Function**	Allows the Digital output (N/C (12)) to be mapped to different functions The output will change in proportion with the selected output	Off	End of list	Error		Read/Write
PNU 11904 **I/O** **Digital Outputs** **Digital Output 1 N/C(12)** **High Output = 1 When Value**	Allows the polarity of the output to be reversed On : When the selected function is on the output will be on. Off : When the selected function is on the output is off	Off	On	On		Read/Write
PNU 11585 **I/O** **Digital Outputs** **Digital Output 2 N/O(24)** **Select Function**	Allows the Digital output (N/0 (24)) to be mapped to different functions The output will change in proportion with the selected output	Off	End of list	Error		Read/Write
PNU 11906 **I/O** **Digital Outputs** **Digital Output 2 N/O(24)** **High Output = 1 When Value**	Allows the polarity of the output to be reversed On : When the selected function is on the output will be on. Off : When the selected function is on the output is off	Off	On	On		Read/Write

3. Configuration and Parameters (continued)

3.10 Input / Output (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 11908 **I/O** **Digital Outputs** **Digital Output 3 N/O(34)** **High Output = 1 When Value**	Allows the polarity of the output to be reversed On : When the selected function is on the output will be on. Off : When the selected function is on the output is off	Off	On	On		Read/Write
PNU 11587 **I/O** **Digital Outputs** **Digital Output 4 N/O(44)** **Select Function**	Allows the Digital output (N/0 (44)) to be mapped to different functions The output will change in proportion with the selected output	Off	End of list	End Of Start		Read/Write
PNU 11910 **I/O** **Digital Outputs** **Digital Output 4 N/O(44)** **High Output = 1 When Value**	Allows the polarity of the output to be reversed On : When the selected function is on the output will be on. Off : When the selected function is on the output is off	Off	On	On		Read/Write
PNU 9600 **I/O** **Analogue Inputs** ↓ **Analogue Input Type**	Defines the function of the analogue input (AI) 0-10V : The input voltage varies from 0-10V 4-20mA : The input varies from 4 to 20mA	0 - 10V	4 - 20mA	0 - 10V		Read/Write

3. Configuration and Parameters (continued)

3.10 Input / Output (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 9728 **I/O** **Analogue Inputs** ↓ **Scaling Level**	Allows the selected function to be scaled The selected function will change in proportion with the input The function will be at its "Scaling Level" when the input is at its maximum	0	Max value	Max value	%	Read/Write
PNU 8960 **I/O** **Analogue Outputs** ↓ **Analogue Output Type**	Defines the physical function of the analogue output (AO) 0-10V : The output voltage varies from 0 to 10V 4-20mA : The output current varies from 4 to 20mA	0 - 10V	4 - 20mA	0 - 10V		Read/Write
PNU 9024 **I/O** **Analogue Outputs** ↓ **Select Function**	Allows the Analogue output to be mapped to different PNU functions The output will change in proportion with the selected function By default the output will be at a maximum when the selected function equals its maximum value	Off	End of list	Off		Read/Write
PNU 9088 **I/O** **Analogue Outputs** ↓ **Scaling Level**	Allows the selected function to be scaled The output will change in proportion with the selected function The output will be at a maximum when the selected function equals the "Scaling Level"	0	Max value	0	%	Read/Write

3. Configuration and Parameters (continued)

3.10 Input / Output (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 53794 **I/O** ↓ ↓ **PTC Motor Thermistor Trip**	A single PTC motor thermistor or set of PTC motor thermistors can be connected to the PTC terminals. On :The Unit will trip if the motor thermistor exceed its response temperature or the PTC input is open circuit Off : The Unit will continue to operate.	Off	On	Off		Read/Write

3. Configuration and Parameters (continued)

3.11 Monitor

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 32000 **Monitor** ↓ ↓ **Line Frequency**	The frequency of the 3-phase supply	45	65	-	Hz	Read Only
PNU 32064 **Monitor** ↓ ↓ **Phase Rotation**	Indicates the phase sequence of the incoming supply. RYB = L1-L2-L3 RBY = L1-L3-L2	L1-L2-L3	L1-L3-L2	L1-L2-L3		Read Only
PNU 33536 **Monitor** ↓ ↓ **I1**	The RMS current on phase L1	0	10000	0	A	Read Only
PNU 33536 **Monitor** ↓ ↓ **I2**	The RMS current on phase L1	0	10000	0	A	Read Only

Continued overleaf

3. Configuration and Parameters (continued)

3.11 Monitor (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 33540 **Monitor** ↓ ↓ **I3**	The RMS current on phase L3	0	1000	0	A	Read Only
PNU 32896 **Monitor** ↓ ↓ **Current Irms**	The RMS motor current This is the maximum of the 3 phases. This value is used for the overload and power calculations	0	10000	0	A	Read Only
PNU 33024 **Monitor** ↓ ↓ **True Power Factor**	The True Power Factor (Estimated) The True Power Factor = (Displacement Power Factor x Distortion Power Factor)	0	1	0		Read Only
PNU 34688 **Monitor** ↓ ↓ **True Power P**	Total true power (Estimated) This is an addition of the 3 phases	0	10000	0	kW	Read Only

3. Configuration and Parameters (continued)

3.11 Monitor (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 34816 **Monitor** ↓ ↓ **Apparent Power S**	Total Apparent Power (Estimated) This is an addition of the 3 phases	0	10000	0	kVA	Read Only
PNU 35008 **Monitor** ↓ ↓ **iERS Saving Level**	Indicates the level of potential saving 100% indicates that Unit is saving at its maximum level Does not indicated real percentage saving	0	100	0	%	Read Only
PNU 22400 **Monitor** ↓ ↓ **Delay Angle**	Internal firing delay angle in Degrees Displayed for diagnostic purposes	0	60	0	Degrees	Read Only
PNU 23040 **Monitor** ↓ ↓ **BackStop**	The maximum possible Delay angle for the current iERS saving phase Displayed for diagnostic purposes May decrease during heavy load periods or instability	0	55	0	Degrees	Read Only

3. Configuration and Parameters (continued)

3.11 Monitor (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 22464 **Monitor** ↓ ↓ **Delay Max**	The maximum possible delay for iERS saving Displayed for diagnostic purposes	0	55	0	Degrees	Read Only
PNU 21320 **Monitor** ↓ ↓ **Start Saving Level**	The current in Amps at which the iERS is enabled or disabled. The iERS function is active when the motor current is less than the "Start Saving Level" When the iERS function is disabled internal bypass relays close to improve efficiency.	50% I-motor	80% I-motor	80% I-motor		Read Only
PNU 38400 **Monitor** ↓ ↓ **Last Peak Current**	Displays the peak current of the last successful start.	0	10000	0	A	Read Only
PNU 36544 **Monitor** ↓ ↓ **HeatSink Temp**	The temperature of the internal Unit heatsink. The Unit will trip when the heatsink temperature exceeds 80°C. The internal cooling fans will turn on if this temperature exceeds 40°C	-20	80		°C or °F	Read Only

3. Configuration and Parameters (continued)

3.12 Log

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 60608 **Log** **Trip Log** ↓ **Last Trip**	Displays the last Fault trip	0	65535	0		Read Only
PNU 60609 **Log** **Trip Log** ↓ **Last Trip -1**	Displays the last Fault trip -1	0	65535	0		Read Only
PNU 60611 **Log** **Trip Log** ↓ **Last Trip -3**	Displays the last Fault trip -3	0	65535	0		Read Only
PNU 60612 **Log** **Trip Log** ↓ **Last Trip -4**	Displays the last Fault trip -4	0	65535	0		Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 60614 **Log** **Trip Log** ↓ **Last Trip -6**	Displays the last Fault trip -6	0	65535	0		Read Only
PNU 60615 **Log** **Trip Log** ↓ **Last Trip -7**	Displays the last Fault trip -7	0	65535	0		Read Only
PNU 60617 **Log** **Trip Log** ↓ **Last Trip -9**	Displays the last Fault trip -9	0	65535	0		Read Only
PNU 100101 **Log** **Trip Log** **Trip Code Descriptions** **101** **Input Side Phase Loss**	Phase L1 missing at the instant of start up. The L1 phase is either missing or at a very low level Check all incoming connections. If a main contactor is being controlled by a digital output set to "Running" check contactor delay is sufficient					Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 100102 **Log** **Trip Log** **Trip Code Descriptions** **102** **Input Side Phase Loss**	Phase L2 missing at the instant of start up. The L2 phase is either missing or at a very low level Check all incoming connections. If a main contactor is being controlled by a digital output set to "Running" check contactor delay is sufficient					Read Only
PNU 100103 **Log** **Trip Log** **Trip Code Descriptions** **103** **Input Side Phase Loss**	Phase L3 missing at the instant of start up The L3 phase is either missing or at a very low level Check all incoming connections. If a main contactor is being controlled by a digital output set to "Running" check contactor delay is sufficient					Read Only
PNU 100104 **Log** **Trip Log** **Trip Code Descriptions** **104 - 117** **Input Side Phase Loss**	Any or all phases missing when the motor is being controlled L1 L2 or L3 phase are missing or at a very low level. Check all incoming connections. Check any fuses / breakers incorporated in the power circuit					Read Only
PNU 100201 **Log** **Trip Log** **Trip Code Descriptions** **201** **Max. Temp. Exceeded**	Internal heatsink temperature has exceeded 90°C It is possible the Unit is operating outside specified limits. Check enclosure ventilation and airflow around the Unit. If the unit trips immediately the internal temperature sensor could be faulty.					Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 100208 **Log** **Trip Log** **Trip Code Descriptions** **208 Thermal Sensor Trip**	Thermal sensor Failure The internal temperature sensor has failed Contact the supplier					Read Only
PNU 100301 **Log** **Trip Log** **Trip Code Descriptions** **301-308 Thyristor Firing Trip**	One or more of the internal control thyristors (SCRs) have failed to turn on properly. (In-Line "Firing Mode") The Unit has detected that the SCRs are not operating as expected. Check all incoming and outgoing connections.					Read Only
PNU 100351 **Log** **Trip Log** **Trip Code Descriptions** **350-358 Thyristor Firing Trip**	One or more of the internal control thyristors (SCRs) have failed to turn on properly. (Delta "Firing Mode") The Unit has detected that the SCRs are not operating as expected. Check all incoming and outgoing connections.					Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 100401 **Log** **Trip Log** **Trip Code Descriptions** **401** **Motor Side Phase Loss**	One or all of the phases are missing on the motor side during the instant of start up T1 T2 or T3 phase are missing or at a very low level. Check that the motor is connected to T1 T2 and T3. Ensure any disconnecting device between the Unit and the motor is closed at the instant of start .					Read Only
PNU 100402 **Log** **Trip Log** **Trip Code Descriptions** **402-403** **Motor Side Phase Loss**	One or all of the phases are missing on the motor side during the instant of start up when the motor being controlled T1 T2 or T3 phase are missing or at a very low level. Check all incoming and outgoing connections.					Read Only
PNU 100601 **Log** **Trip Log** **Trip Code Descriptions** **601** **Control Voltage Too Low**	The internal control supply of the Unit level has fallen to a low level Can be caused by a weak 24VDC control supply. Ensure 24VDC supply meets the requirements specified in the Quick Start Guide.					Read Only
PNU 100701 **Log** **Trip Log** **Trip Code Descriptions** **701-710** **Sensing Fault Trip**	One or more of the internal control thyristors (SCRs) have failed to turn on properly. The Unit has detected that the SCRs are not operating as expected. Check connections all incoming and outgoing connections					Read Only

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3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 100801 **Log** **Trip Log** **Trip Code Descriptions** **801-802 Fan Problem**	One or more of the internal cooling fans has failed To ensure the heatsink is cooled sufficiently the Unit Will trip if the fans fail to operate Check Unit fans for signs of damage or contamination					Read Only
PNU 101001 **Log** **Trip Log** **Trip Code Descriptions** **1001 Short Circuit Thyristor**	One or more of the internal control thyristors (SCRs) have failed short circuit The Unit has detected that the SCRs are not operating as expected. ISOLATE SUPPLY + MOTOR Disconnect supply. Check by measuring the resistance between L1-T1 L2-T2 L3-T3 (Anything < 10R is assumed short circuit)					Read Only
PNU 101101 **Log** **Trip Log** **Trip Code Descriptions** **1101 Low Current Trip**	The motor current has been lower than the low trip level for the low trip time This trip is not active during soft start and soft stop and is "off" by default. If the low current trip is not required turn "off" in "Trip Settings".					Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 101201 **Log** **Trip Log** **Trip Code Descriptions** **1201 Current Limit Timeout Trip**	The motor has been held in current limit longer than the "Start current limit Time" It is likely that the current limit level has been set too low for the application. Increase the current limit level or timeout period.					Read Only
PNU 101202 **Log** **Trip Log** **Trip Code Descriptions** **1202 Current Limit Timeout Trip**	The motor has been held in current limit longer than the "Stop current limit Time" It is likely that the current limit level has been set too low for the application. Increase the current limit level or timeout period.					Read Only
PNU 101301 **Log** **Trip Log** **Trip Code Descriptions** **1301 Overload Trip**	The "Overload" has exceeded 100% The Unit is attempting to start an application that is outside its capacity or it is starting too often. Refer to the overload trip curves to determine whether the Unit has been sized correctly.					Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 101302 **Log** **Trip Log** **Trip Code Descriptions** **1302 Overload Trip**	The motor current has exceeded 475% (i-Unit) for a time greater than 250ms The Unit is attempting to start an application that is outside its capacity with a "high current limit level" set Refer to the overload trip curves to determine whether the Unit has been sized correctly and check current limit level.					Read Only
PNU 101401 **Log** **Trip Log** **Trip Code Descriptions** **1401 Shearpin Trip**	The motor current has been higher than the "Shearpin Trip Level" for the trip time. This trip is not active during soft start and soft stop and is "off" by default. If Shearpin trip is not required turn "off" in "Trip Settings".					Read Only
PNU 101501 **Log** **Trip Log** **Trip Code Descriptions** **1501 PTC Thermistor Trip**	The PTC thermistor value has exceed the trip level. The PTC thermistor connected to the PTC input has exceeded it response temperature or the PTC input is open circuit. If the PTC TRIP is not required turn "off" in "Trip Settings".					Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 101601 **Log** **Trip Log** **Trip Code Descriptions** **1601 External Trip**	External Trip The input programmed to External Trip is active If the External trip is not required turn "off" in "Trip settings					Read Only
PNU 101701 **Log** **Trip Log** **Trip Code Descriptions** **1701 Communications Trip**	Communications failure The command or status PNU has not ben polled in the time set in the "Timeout" period If the communication trip is disabled the Unit cannot be stopped in the communications fail					Read Only
PNU 101801 **Log** **Trip Log** **Trip Code Descriptions** **1801-1802 Bypass Relay Trip**	One or more of the internal bypass relays has failed to close The internal bypass relay has failed or the control supply is to weak. Ensure 24VDC supply meets the requirements specified in the Quick Start Guide.					Read Only
PNU 101802 **Log** **Trip Log** **Trip Code Descriptions** **1803 Bypass Relay Trip**	One or more of the internal bypass relays has failed to open The internal bypass relay has failed or the control supply is too weak. Ensure 24VDC supply meets the requirements specified in the Quick Start Guide.					Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 101901 **Log** **Trip Log** **Trip Code Descriptions** **1901 Cover Open, Close to Enable Motor Start**	The Unit cover is open The cover is open or not closed properly Close Cover or if Cover trip is not required turn off in "Trip Settings"					Read Only
PNU 102001 **Log** **Trip Log** **Trip Code Descriptions** **2001-2003 Remote Start is Enabled**	The remote start signal is active. The remote start signal was active during power up or Reset or Parameter Load. Turn off remote or if Remote On trip is not required turn "off" in "Trip Settings"					Read Only
PNU 102101 **Log** **Trip Log** **Trip Code Descriptions** **2101 Rotation L1 L2 L3 Trip**	The input phase rotation is RYB (L1-L2-L3) The phase rotation is opposite to that required. Change phase rotation or if "RYB" trip is not required turn "off" in trip settings.					Read Only
PNU 102102 **Log** **Trip Log** **Trip Code Descriptions** **2102 Rotation L1 L3 L2 Trip**	The input phase rotation is RBY (L1-L3-L2) The phase rotation is opposite to that required. Change phase rotation or if "RBY" trip is not required turn "off" in trip settings.					Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 102104 **Log** **Trip Log** **Trip Code Descriptions** **2201-2299 2701-2799 MPU Trip**	Internal Unit Failure The Unit has failed internally and is unable to recover automatically. Cycle the control supply. If the fault is not cleared then contact the supplier					Read Only
PNU 102201 **Log** **Trip Log** **Trip Code Descriptions** **2301-2303 Current Sensor Trip**	Current sensor failure One or more of the internal sensors used to measure current has failed or is reading a low value. Check the connections to the supply and motor as disconnection will result in a zero current reading. Check the plate FLA of the motor being controlled is at least 25% of the "i-motor" rating					Read Only
PNU 102202 **Log** **Trip Log** **Trip Code Descriptions** **2401-2499 Operation 3 Trip**	Fail Safe operation A process associated with the Control Board has been affected and is unable to recover automatically The trip MUST be reset by either the digital input or keypad or the bus command depending on the control method set. This trip is a special case and it is NOT possible to reset this trip by cycling the control supply					Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 102203 **Log** **Trip Log** **Trip Code Descriptions** **2501-2599 Operation 1 Trip**	Fail Safe operation A process associated with the Keypad board has been affected and is unable to recover automatically The trip can be reset by either the digital input or keypad or the bus command depending on the control method set. It is also possible to reset this trip by cycling the control supply					Read Only

Continued overleaf

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 102204 **Log** **Trip Log** **Trip Code Descriptions** **2601-2699 Operation 2 Trip**	Fail Safe operation A process associated with the Logging function has been affected and is unable to recover automatically The trip can be reset by either the digital input or keypad or the bus command depending on the control method set. It is also possible to reset this trip by cycling the control supply					Read Only
PNU 38400 **Log** **Trip Log** ↓ **Last Peak Current**	Displays the peak current of the last successful start.	0	10000	0	A	Read Only
PNU 38402 **Log** **Trip Log** ↓ **Last peak start current -1**	Displays the peak current of the last successful start -1	0	10000	0	A	Read Only
PNU 38404 **Log** **Trip Log** ↓ **Last peak start current -2**	Displays the peak current of the last successful start -2	0	10000	0	A	Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 38406 **Log** **Trip Log** ↓ **Last peak start current -3**	Displays the peak current of the last successful start -3	0	10000	0	A	Read Only
PNU 38408 **Log** **Trip Log** ↓ **Last peak start current -4**	Displays the peak current of the last successful start -4	0	10000	0	A	Read Only
PNU 38410 **Log** **Trip Log** ↓ **Last peak start current -5**	Displays the peak current of the last successful start -5	0	10000	0	A	Read Only
PNU 38414 **Log** **Trip Log** ↓ **Last peak start current -7**	Displays the peak current of the last successful start -7	0	10000	0	A	Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 38416 **Log** **Trip Log** ↓ **Last peak start current -8**	Displays the peak current of the last successful start -8	0	10000	0	A	Read Only
PNU 38418 **Log** **Trip Log** ↓ **Last peak start current -9**	Displays the peak current of the last successful start -9	0	10000	0	A	Read Only
PNU 39040 **Log** **Trip Log** ↓ **Last peak stop current**	Displays the peak current of the last successful stop	0	10000	0	A	Read Only
PNU 39044 **Log** **Trip Log** ↓ **Last peak stop current -2**	Displays the peak current of the last successful stop -2	0	10000	0	A	Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 39046 **Log** **Trip Log** ↓ **Last peak stop current -3**	Displays the peak current of the last successful stop -3	0	10000	0	A	Read Only
PNU 39048 **Log** **Trip Log** ↓ **Last peak stop current -4**	Displays the peak current of the last successful stop -4	0	10000	0	A	Read Only
PNU 39050 **Log** **Trip Log** ↓ **Last peak stop current -5**	Displays the peak current of the last successful stop -5	0	10000	0	A	Read Only
PNU 39054 **Log** **Trip Log** ↓ **Last peak stop current -7**	Displays the peak current of the last successful stop -7	0	10000	0	A	Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 39056 **Log** **Trip Log** ↓ **Last peak stop current -8**	Displays the peak current of the last successful stop -8	0	10000	0	A	Read Only
PNU 39058 **Log** **Trip Log** ↓ **Last peak stop current -9**	Displays the peak current of the last successful stop -9	0	10000	0	A	Read Only
PNU 39680 **Log** **Trip Log** ↓ **Last temperature**	Displays the heatsink temperature at the end of the last successful start	-20	80		°C	Read Only
PNU 39682 **Log** **Trip Log** ↓ **Last temperature -2**	Displays the heatsink temperature at the end of the last successful start -2	-20	80		°C	Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 39683 **Log** **Trip Log** ↓ **Last temperature -3**	Displays the heatsink temperature at the end of the last successful start-3	-20	80		°C	Read Only
PNU 39684 **Log** **Trip Log** ↓ **Last temperature -4**	Displays the heatsink temperature at the end of the last successful start-4	-20	80		°C	Read Only
PNU 39685 **Log** **Trip Log** ↓ **Last temperature -5**	Displays the heatsink temperature at the end of the last successful start-5	-20	80		°C	Read Only
PNU 39686 **Log** **Trip Log** ↓ **Last temperature -6**	Displays the heatsink temperature at the end of the last successful start-6	-20	80		°C	Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 39688 **Log** **Trip Log** ↓ **Last temperature -8**	Displays the heatsink temperature at the end of the last successful start-8	-20	80		°C	Read Only
PNU 39689 **Log** **Trip Log** ↓ **Last temperature -9**	Displays the heatsink temperature at the end of the last successful start-9	-20	80		°C	Read Only
PNU 40320 **Log** **Trip Log** ↓ **Last overload**	Displays the overload level at the end of the last successful start	0	100	0	%	Read Only
PNU 40321 **Log** **Trip Log** ↓ **Last overload-1**	Displays the overload level at the end of the last successful start -1	0	100	0	%	Read Only

3. Configuration and Parameters (continued)

3.12 Log (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 40323 **Log** **Trip Log** ↓ **Last overload-3**	Displays the overload level at the end of the last successful start -3	0	100	0	%	Read Only
PNU 40324 **Log** **Trip Log** ↓ **Last overload-4**	Displays the overload level at the end of the last successful start -4	0	100	0	%	Read Only
PNU 40325 **Log** **Trip Log** ↓ **Last overload-5**	Displays the overload level at the end of the last successful start -5	0	100	0	%	Read Only
PNU 40326 **Log** **Trip Log** ↓ **Last overload-6**	Displays the overload level at the end of the last successful start -6	0	100	0	%	Read Only

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3. Configuration and Parameters (continued)

3.13 Device

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 40328 **Log** **Trip Log** ↓ **Last overload-8**	Displays the overload level at the end of the last successful start -8	0	100	0	%	Read Only
PNU 40329 **Log** **Trip Log** ↓ **Last overload-9**	Displays the overload level at the end of the last successful start -9	0	100	0	%	Read Only
PNU 35840 **Log** **Totals Log** ↓ **Number of Starts**	The total number of successful starts	0	4294836225	0		Read Only
PNU 100005 **Log** ↓ ↓ **Download Log File**	Download the full log file on to the USB stick The Unit logs several parameters during normal and fault conditions Data is stored in CSV format. Please send all downloaded files to SIT Automation on request					Read/Write

3. Configuration and Parameters (continued)

3.13 Device (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 40328 **Log** **Trip Log** ↓ **Last overload-8**	Displays the overload level at the end of the last successful start -8	0	100	0	%	Read Only
PNU 100001 **Device** ↓ ↓ **Date**	Enter current date Date format can be set to either dd/mm/yyyy or mm/dd/yyyy. Refer to "Date format" parameter.					Read/Write
PNU 14720 **Device** ↓ ↓ **Time**	Allows the time to be changed to 'local' time By default the time is set to GMT	-	-	GMT time	hh: mm: ss	Read/Write
PNU 13376 **Device** ↓ ↓ **Language**	Selects the display language for the keypad Enter the required language from the displayed list	English	End of list	English		Read/Write

3. Configuration and Parameters (continued)

3.13 Device (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 12864 **Device** ↓ ↓ **Passcode**	Stops unauthorised access to read/ write parameters For the passcode be active the "Screen lock" must be turned on	0	Max Value	0		Read/Write
PNU 16000 **Device** **Networks** **Modbus Network Settings** **Address**	Sets the Modbus station number	1	32	1		Read/Write
PNU 16064 **Device** **Networks** **Modbus Network Settings** **Baud Rate**	Sets the serial communications baud rate The available baud rates are 9600 19200 38400 57600 or 115200	9600	115200	19200		Read/Write
PNU 14080 **Device** **Networks** **Modbus Network Settings** **Traffic LEDS**	Allows the user to check the state of the modbus communication network. Red LED receive. Green LED Transmit. On : The Red and Green LEDS display the traffic on the Modbus communications network Off : The Red and Green LEDs display the Unit status information	Off	On	Off		Read/Write

3. Configuration and Parameters (continued)

3.13 Device (continued)

Menu	Description	Min	Max	Default	Unit	Reg. Type
PNU 16128 **Device** **Networks** **Modbus Network Settings** **Parity**	Sets the serial communications parity bit The available parity options are None Even Odd Also sets the stop bits. No parity uses 2 stop bits. Odd or even parity uses 1 stop bit	None	Odd	Even		Read/Write
PNU 15808 **Device** **Networks** ↓ **Timeout ms**	Communications trip Timeout period To prevent a 'Communications Trip' (If enabled) the bus must be kept active. To keep the bus active there must be at least one Modbus read or write (any PNU) during the "Timeout ms" period	0	60000	5000	ms	Read/Write
PNU 62080 **Device** ↓ ↓ **Reset Defaults**	Restores the Unit to the factory defaults	No	Yes	No		Read/Write
PNU 100003 **Device** ↓ ↓ **About**	Gives the Model number. Serial Number and current software versions The software versions are STS1xxxxxx STS2xxxxxx and STS3xxxxxx.					Read Only

3. Configuration and Parameters (continued)

3.13 Device (continued)

3. Configuration and Parameters (continued)

						Reg. Type
PNU 12992 **Device** ↓ ↓ **Screen Lock**	Stops unauthorised access to read/ write parameters	Off	On	Off		Read/Write
PNU 13312 **Device** ↓ ↓ **Temperature Format**	Selects °C or °F for displayed temperatures °C : All displayed temperatures are °C °F : All displayed temperatures are °F	°C	°F	°C		Read/Write
PNU 62272 **Device** ↓ ↓ **Parameters to USB**	Allows the user to save parameters Downloads the parameters from the Unit to the USB drive Data is stored in CSV format.	No	Yes	No		Read/Write
PNU 62336 **Device** ↓ ↓ **Parameters from USB**	Allows the user to load parameters stored on a USB flash drive Uploads the parameters from the USB drive to the Unit Data is stored in CSV format.	No	Yes	No		Read/Write
PNU 13120 **Device** ↓ ↓ **Service Code**	Diagnostic parameter For SIT Automation use only					

3.13 Device (continued)

3.13.1 Saving and Loading a STS™ Configuration File

The operating parameters of the unit can be copied onto a USB flash drive. To do this, attach the USB flash drive into the USB port under the front cover just above the touchscreen.

From the Device Setting menu on STS™ Home screen, scroll down to the third menu and select "Parameters to USB." This will create a file called PARAMS.CSV, and copy it to a PARAM folder on the stick. There is no way to rename the file during the save process. If you have another PARAMS.CSV file on the flash drive, it will be overwritten. It is suggested that parameter files be archived in a separate folder with a unique name other than PARAM. A new parameter configuration must be configured on STS™ and saved using the method described above. It is not recommended to open the .CSV file and edit parameters on a PC and resave the PARAMS file.

There is also the option to copy "Parameters From USB," which gives the ability to restore or set parameters to a known state (on the same or another STS™ unit). This function will only work on a file called PARAMS.CSV in the PARAM folder of the stick. Any other files in that folder will be ignored.

3.13.2 Saving a Log file

A log file may be used to help solve performance issues that may arise. You may be asked to download this by your supplier.

From the Log menu on the Home screen, scroll down to the second menu and select "Download Log File." The LOG folder is created when the user connects a flash drive and selects "Download Log file"from the LOG menu. As an aid to help analyses, the log file(s) [Unit Serial Number].CSV is also created and copied into the LOG folder.

Part number USB-KEY is a USB flash drive that has been verified to work with STS™. Other flash drives may not physically fit, or may not perform correctly.

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3. Configuration and Parameters (continued)

3.14 Functional Summaries

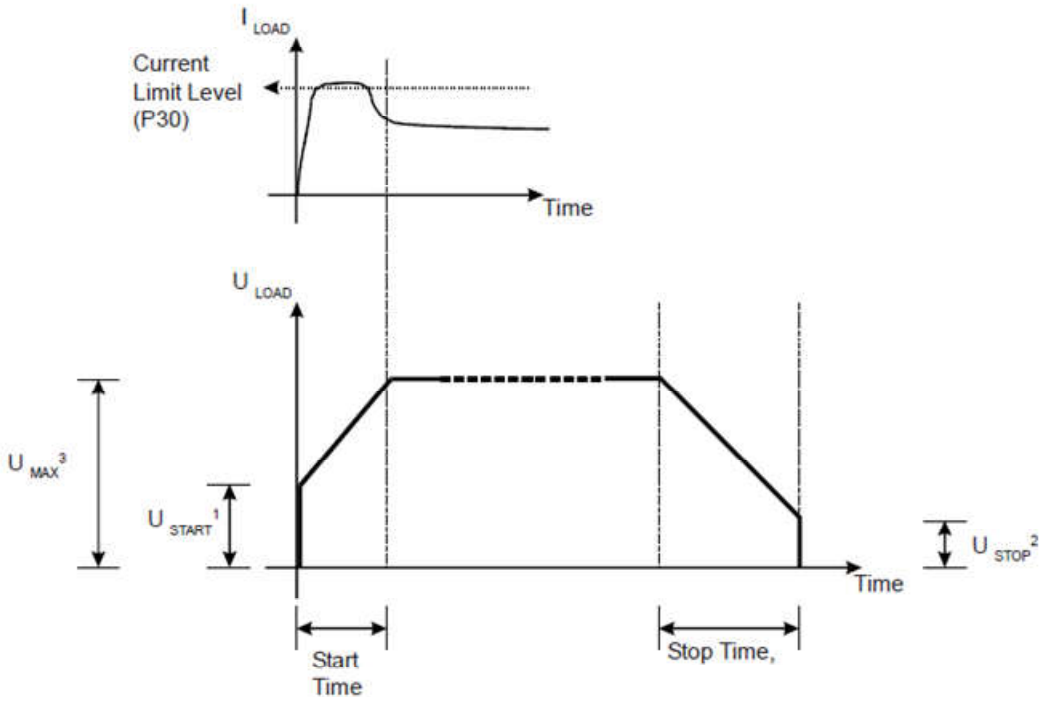
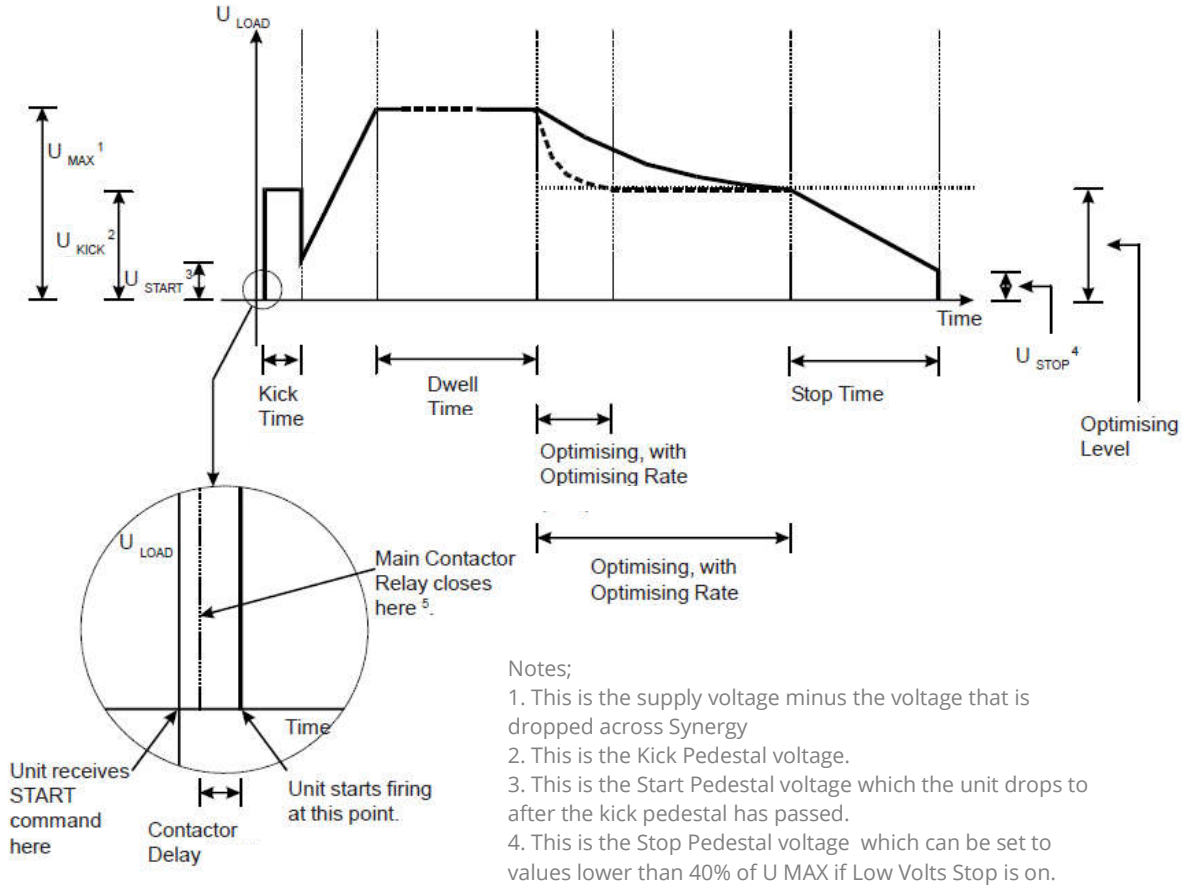


Figure 3.14.1: 'Basic' Functions

(continued overleaf)

3. Configuration and Parameters (continued)

3.14 Functional Summaries (continued)



Notes;
1. This is the supply voltage minus the voltage that is dropped across Synergy
2. This is the Kick Pedestal voltage.
3. This is the Start Pedestal voltage which the unit drops to after the kick pedestal has passed.
4. This is the Stop Pedestal voltage which can be set to values lower than 40% of U MAX if Low Volts Stop is on.
5. This relay brings in the contactor that supplies the three phase AC mains to the unit in the standard wiring configuration
(see Electrical Installation section 2.1
6. Represented by the thick dotted line.
7. Represented by the thick unbroken line.

Figure 3.14.2: 'Advanced' Functions

(continued overleaf)

3. Configuration and Parameters (continued)

3.14 Functional Summaries (continued)

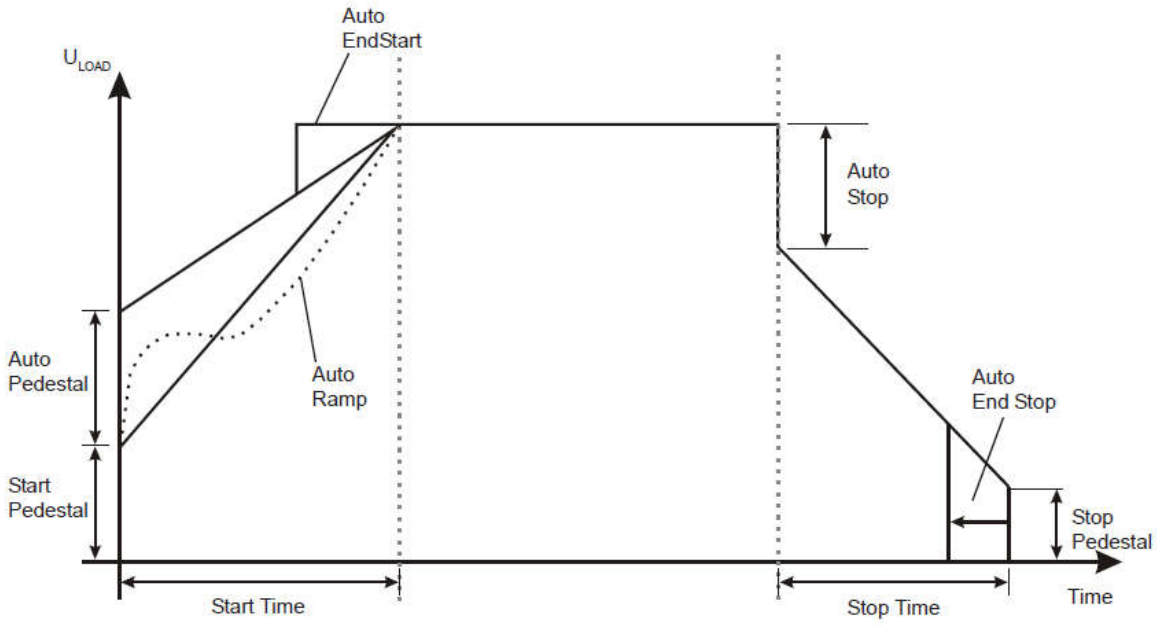
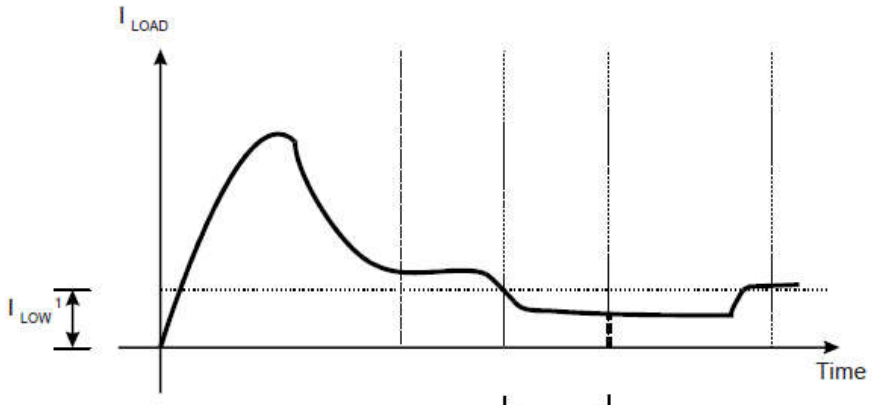


Figure 3.14.3: 'Auto' Functions

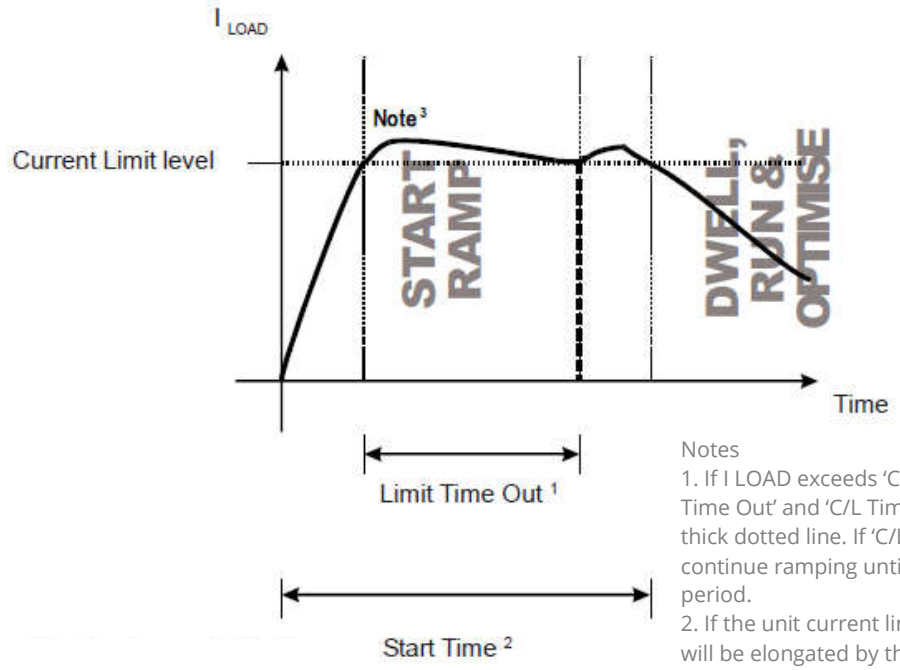


Notes
1. I_{LOW} = Low Amps Level.
2. If I_{LOAD} drops below 'Low Amps Level' and 'Low Current' is set to 'on', and 'Low Amps Time' is set to minimum then the unit will trip as indicated by the short thick dotted line.
3. If 'Low Amps Time' is set to maximum and I_{LOAD} rises above 'Low Amps Level' before 'Low Amps Time' has elapsed then the unit will not trip.

Figure 3.14.4: Low Current Protection Function

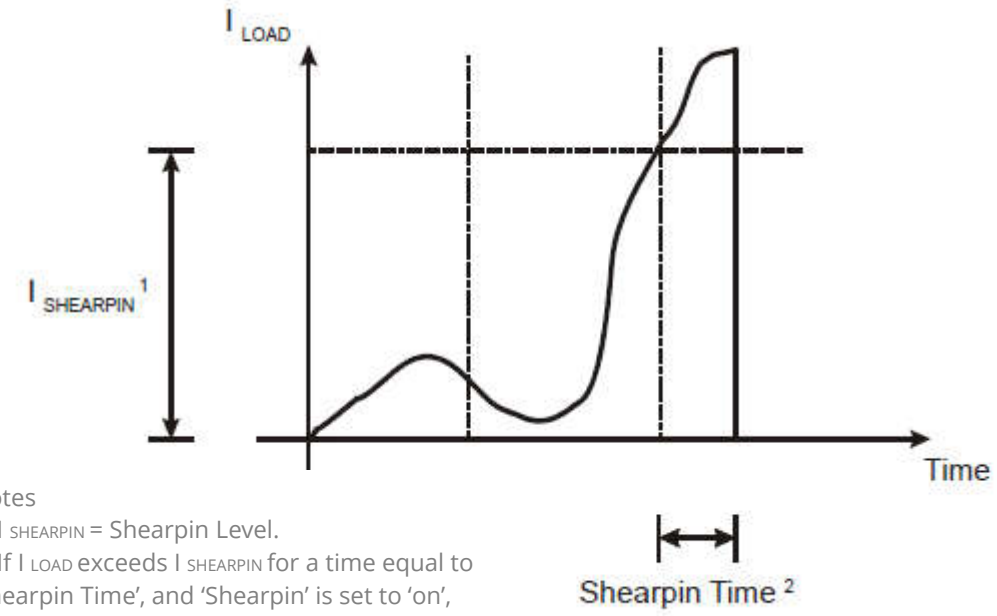
3. Configuration and Parameters (continued)

3.14 Functional Summaries (continued)



Notes
1. If I LOAD exceeds 'Current Limit Level' for time 'Limit Time Out' and 'C/L Time Out' is on, the unit will trip at the thick dotted line. If 'C/L Time Out' is off the unit will continue ramping until T.O.R. and then enter the Dwell period.
2. If the unit current limits during start-up the start time will be elongated by the amount of time that the unit was current limiting.
3. The actual current rises slightly above the level set in 'Current Limit' because the unit manages the current through control of the thyristor firing delay angle.

Figure3.14.5: Current Limit Function



Notes
1. I SHEARPIN = Shearpin Level.
2. If I LOAD exceeds I SHEARPIN for a time equal to 'Shearpin Time', and 'Shearpin' is set to 'on', then the unit will trip as indicated.

Figure 3.14.6: Shearpin Function

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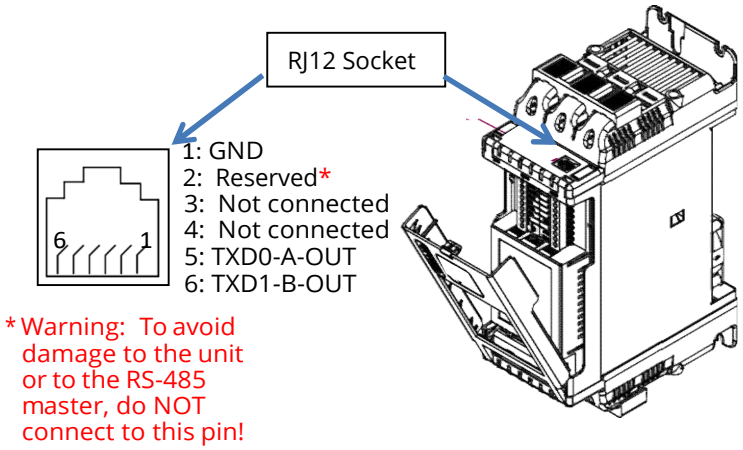
4. Communication

Chapter 4

4.1 Modbus RTU Serial Communications

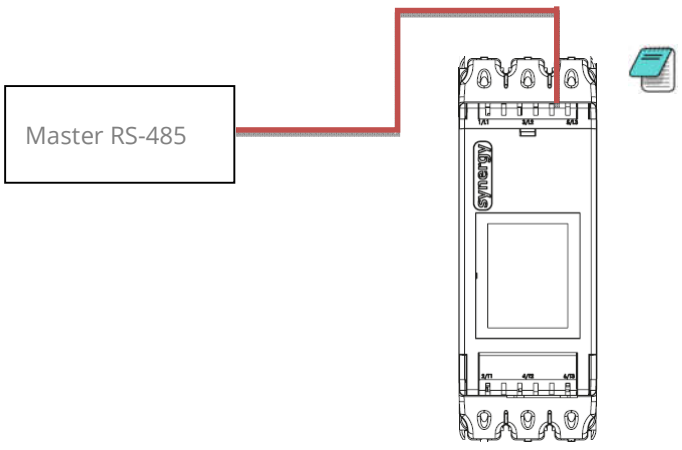
4.1.1 Modbus RTU Communications Interface

All STS™ soft starts support Modbus RTU as standard. The RS-485 communications are accessible from the RJ12 connector (see below).



4.1.2 Modbus RTU Connections

Single STS RS-485 network

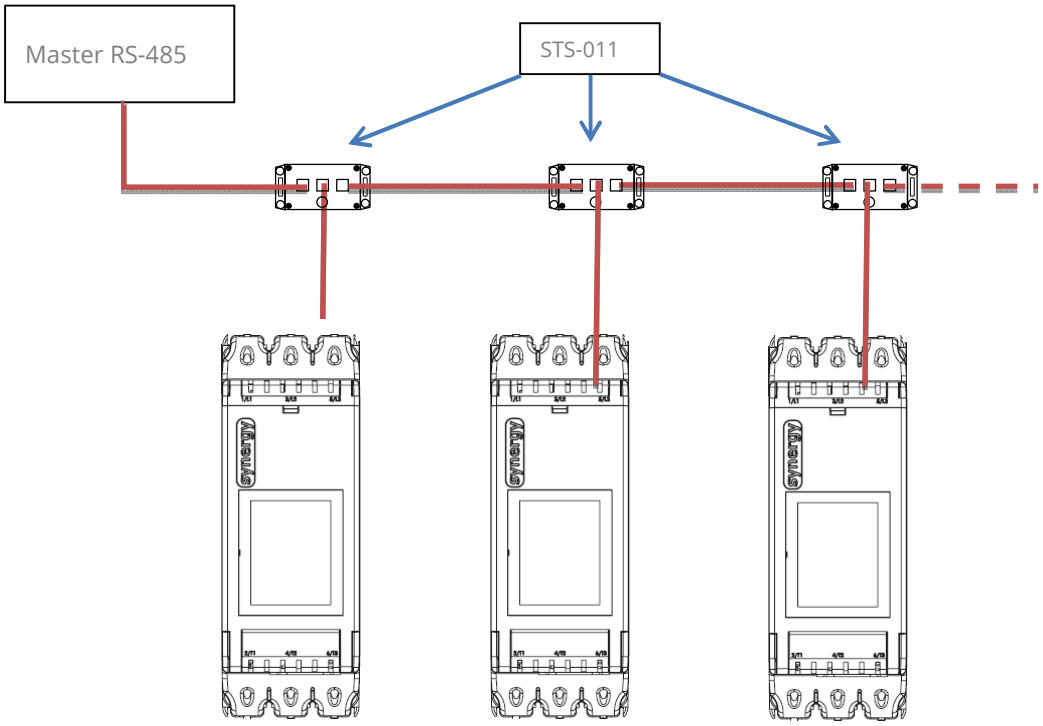


'Splitter' STS-011 is optional for this configuration

4. Communication (continued)

Multiple STS RS-485 network. One STS-011 per STS recommended.

One STS-011 per synergy recommended.



4.1.3 Modbus Communications Configuration

The Modbus communication settings may be configured from the Device menu:

- Device >> Networks >> Modbus Network Settings >> Address (1 – 32)
- Device >> Networks >> Modbus Network Settings >> Baud (9600 – 115200)
- Device >> Networks >> Modbus Network Settings >> Parity (Odd / Even)
- (Data bits = 8, Stop bits = 1)

The communication parameters should be set before connecting the Modbus master.

4.1.4 Transmission Modes

ASCII and RTU transmission modes are defined in the Modbus protocol specification. STS™ uses *only the RTU mode* for the message transmission.

4. Communication (continued)

4.1.5 Message Structure For RTU Mode

The Modbus RTU structure uses a master-slave system for message exchange. In the case of the STS system, it allows up to 32 slaves, and one master. Every message begins with the master making a request to a slave, which responds to the master in a defined structure. In both messages (request and answer), the used structure is the same:

- Address, Function Code, Data and CRC.

Master (request message):

Address (1 byte)	Function (1 byte)	Request Data (n bytes)	CRC (2 bytes)

Slave (response message):

Address (1 byte)	Function (1 byte)	Response Data (n bytes)	CRC (2 bytes)

4.1.6 Address

The master initiates the communication by sending a byte with the address of the destination slave. When responding, the slave also initiates the message with its own address. Broadcast to address 0 (zero) is not supported.

4.1.7 Function Code

This field contains a single byte, where the master specifies the type of service or function requested to the slave (reading, writing, etc.). According to the protocol, each function is used to access a specific type of data.

4.1.8 Data Field

The format and contents of this field depend on the function used and the transmitted value.

4.1.9 CRC

The used method is the CRC-16 (Cyclic Redundancy Check). This field is formed by two bytes; where first the least significant byte is transmitted (CRC-), and then the most significant (CRC+). The CRC calculation form is described in the Modbus RTU protocol specification.

4.1.10 Supported Functions

Modbus RTU specification defines the functions used to access different types of data.

- STS parameters are defined as *holding type registers*.
- For Modbus RTU/TCP Client devices that use Modicon style addressing, place a 4 as the high digit followed by the Modbus address defined in the parameter mapping table. Note that STS Modbus addressing starts at zero; not 1 as some devices do.
- STS 32-bit parameters are High Word / Low Word in Modbus format.

4. Communication (continued)

4.1.10 Supported Functions (continued)

The following services are available:

Read Holding Registers

Description: reading register blocks of holding register type (block R/W limited to 8 registers).

- Function code: 03

Modbus Function 03 Transaction Table			
Query		*Respons*	
Field	*Hex Byte*	*Field*	*Hex Byte*
Slave address	01	Slave address	01
Function	03	Function	03
Start address Hi	00	Byte count	02
Start address Lo	01	Data Hi	01
No of registers	00	Data Lo	2C
No of registers	01	CRC Lo	B8
CRC Lo	D5	CRC Hi	09
CRC Hi	CA		

Write Single Register

Description: writing in a single register of the holding type.

- Function code: 06

Modbus Function 06 Transaction Table			
Query		*Respons*	
Field	*Hex Byte*	*Field*	*Hex Byte*
Slave address	01	Slave address	01
Function	06	Function	06
Address Hi	00	Address Hi	02
Address Lo	0C	Address Lo	0C
Force data Hi	00	Force data Hi	00
Force data Lo	09	Force data Lo	09
CRC Lo	48	CRC Lo	88
CRC Hi	0C	CRC Hi	77

4. Communication (continued)

4.1.10 Supported Functions (continued)

Write Multiple Registers

Description: writing register blocks of holding register type (block R/W limited to 8 registers).

- Function code: 16

Modbus Function 16 Transaction Table			
Query		*Response*	
Field	*Hex Byte*	*Field*	*Hex Byte*
Slave address	01	Slave address	01
Function	16	Function	16
Address Hi	00	Address Hi	02
Address Lo	0C	Address Lo	0C
Force data Hi	00	Force data Hi	00
Force data Lo	09	Force data Lo	09
CRC Lo	48	CRC Lo	49
CRC Hi	0C	CRC Hi	B4

4.1.11 Memory Map

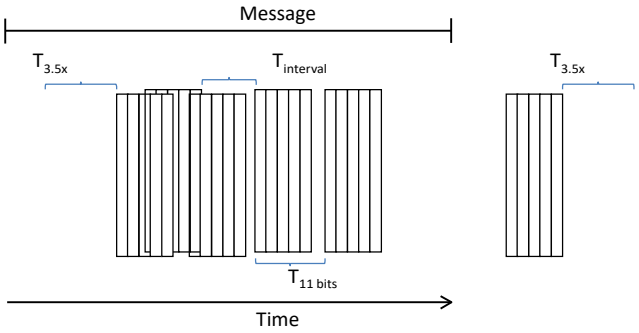
STS™ Modbus communication is based on reading or writing equipment parameters from or to the holding registers. The data addressing is zero offset, such that the parameter Modbus address corresponds to the register number.

Modbus Address Memory Map		
Parameter Modbus Address	*Modbus Data Address*	
	Decimal	*Hexadecimal*
0000	0	0000h
0001	1	0001h
⋮	⋮	⋮
0128	128	0080h
⋮	⋮	⋮

4. Communication (continued)

4.1.12 Message Timing

In the RTU mode there is no specific start or stop byte that marks the beginning or the end of a message. Indication of when a new message begins or when it ends is achieved by the absence of data transmission for a minimum period of 3.5 times the transmission time of a data byte. Thus, in case a message is transmitted after this minimum time has elapsed; the network elements will assume that the first received character represents the beginning of a new message.



4. Communication (continued)

4.2 Modbus TCP

A module is available (part number: AB6223) Modbus TCP network communications. The module has two RJ45 ports for daisy chain connection to multiple units.

Figure 4.2.1 Modbus TCP Communication Module (AB6223)

The Modbus TCP module is installed into the option module slot on the STS unit. See Appendix B for installation instructions.

4.2.1 STS™ Configuration

STS™ will configure automatically when the module is detected.

4.2.2 IP Address Configuration

The IP address of the module and the host STS™ unit is set using an IPConfig tool available from:

http://www.anybus.com/upload/505-8825-IPconfig%20Setup%203.1.1.2.zip

After downloading the above file, unzip it to a temporary folder, and run the executable.

Follow the installation steps.

4. Communication (continued)

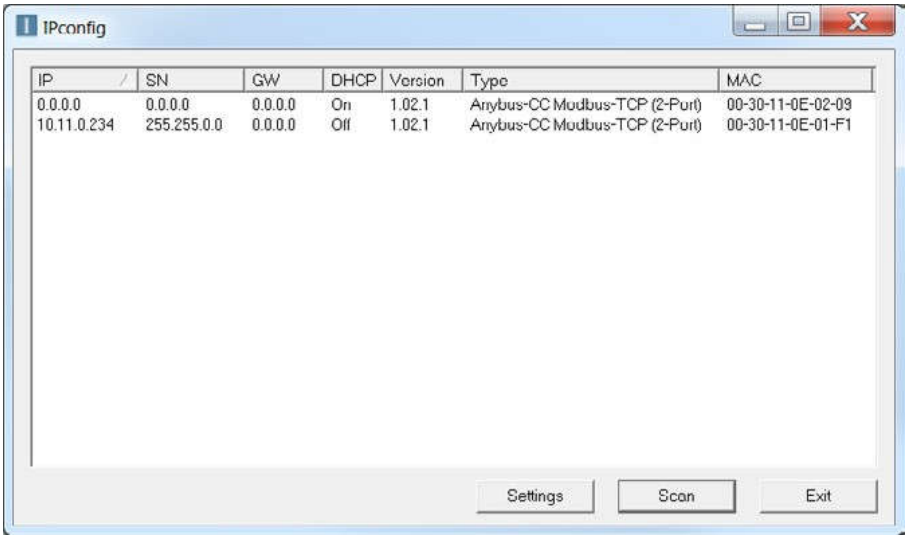
When the installation is complete, locate the download location, and run IPConfig from that folder.

The STSTM with the installed Ethernet /IP module needs to be installed on the same network as the PC running the Ipconfig application.

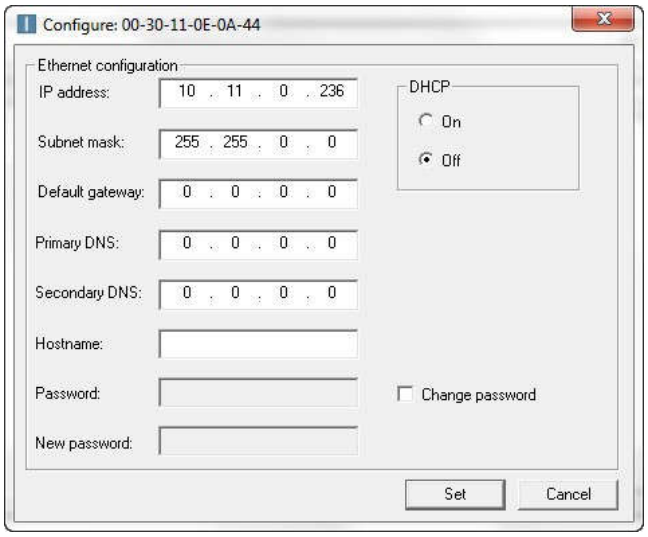
Note: The messaging uses broadcast which will not pass through a router. A switch or direct connection (with cross-over cable) must be used

Start the Ipconfig software. Press the Scan button to have the PC scan for a STS. The IPconfig utility will automatically find STS units on the network.

See screen capture below of two detected STS units located on the network.



Double click the module to be configured. And set the required IP addresses.



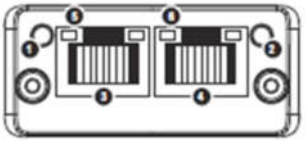
Note: To avoid the IP address being changed by a DHCP server on the network, it is recommend that DHCP is set to OFF

4. Communication (continued)

When all modules have been configured, recycle the corresponding STS units. Confirmation of correct module installation and its IP address can be found in the STS menu under:
Home > Device > Networks.

Note: when entering the 'Networks' menu, the centre button will indicate the type of module installed. If the button states 'Anybus', the module is not installed correctly.

4.2.3 Modbus TCP Module Front Panel Indicators.

Location of Front Panel Indicators		
Item		Front Panel Diagram
1	Network Status LED	
2	Module Status LED	
3	Network Interface, Port	
4	Network Interface, Port	
5	Link/Activity Port 1	
6	Link/Activity Port 2	

Network Interface LED	
LED State	Description
Off	No link, no activity
Green	Link established (100 Mbit/s)
Green,	Activity (100 Mbit/s)
Yellow	Link established (10 Mbit/s)
Yellow,	Activity (10 Mbit/s)

Network Status LED	
LED State	Description
Off	No power or no IP address
Green	Online, connections active
Green, flashing	Online, no connections active
Red	Duplicate IP, fatal error
Red, flashing	Connection timeout

Module Status LED	
LED State	Description
Off	No power
Green	Controlled, Run state
Green, flashing	Not configured or idle state
Red	Major fault
Red, flashing	Recoverable error(s)

4. Communication (continued)

4.2.4 Modbus TCP Functionality

The Modbus TCP Modbus communication module offers the following functionality:

- Dual switched RJ45 communication ports
- 256 bytes of I/O data in each direction
- 100 Mbps full duplex
- Supports 4 simultaneous (master) connections

All Modbus functions and addresses available are detailed in Chapter 5 “Modbus RTU Communications Table”

STS uses Protocol Addressing (Base 0); not PLC Addressing (Base 1). If you are not using the correct selection, all the addresses will be off by 1. Recommended test: monitor a non-critical parameter such as Start Time (address 7104), then manually change the value on the touchscreen and verify that Modbus master actually sees the correct changes.

4. Communication (continued)

4.3 Ethernet /IP

This module provides (part number: AB6213) Ethernet /IP network communications. The module has two RJ45 ports for daisy chain connection to multiple units.

Figure 4.3.1 Ethernet /IP Communication Module (AB6223)

The Ethernet /IP module is installed into the option module slot on the STS unit. See Appendix B for installation instructions.

4.3.1 STS Configuration

STS will configure automatically when the module is detected.

4.3.2 IP Configuration

See Section 4.2.2

4.3.3 Ethernet /IP Module Front Panel Indicators.

See Section 4.2.3

4.3.4 Ethernet /IP Functionality

The EtherNet/IP communication module offers the following functionality:

- CIP Parameter Object Support
- Implicit and Explicit messaging
- Dual switched RJ45 communication ports
- 10/100 Mbps full duplex
- 2 Input Words from the network master to STS
- 2 Output Words from STS to the network master

4.3.5 Ethernet /IP Control

The drive profile used by the interface is currently that provided by the Anybus CC Module and is dictated by the EDS file provided by HMS Industrial Networks.
The EDS describes parameters that can be accessed explicitly in an Acyclic manner. Not all of these parameters are implemented in STS. See Table below. CIP paths from these parameters are described in the EDS.

4. Communication (continued)

Supported Parameters			
#	Description	Read Only?	Implemented?
1	Run Forward	N	Y
2	Run Reverse	N	N
3	Fault Rest	N	Y
4	Net Control	N	Y
5	Net Reference	N	N
6	Speed Reference	N	N
7	Torque Reference	N	N
8	Faulted	Y	Y
9	Warning	Y	Y
10	Running Forward	Y	Y
11	Running Reverse	Y	N
12	Ready	Y	Y
13	Ctrl From Net	Y	Y
14	Ref From Net	Y	N
15	At Reference	Y	N
16	Drive State	Y	Y

The EDS also describes the 25 Implicit Cyclic connections, each of which will set and/or get a combination of the above parameters. The following examples are for connection 6 (Extended Control)

CIP Packet functionality - Extended Control								
O -> T Packet (Control)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	–	–	#4	–	#3	–	–	#1
Byte 1	–	–	–	–	–	–	–	–
T -> O Packet (Status)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	–	–	#13	#12	–	#10	#9	#8
Byte 1	#16							
Note: When a cyclic connection is established and Bit4 (Net Control) is set, the network has control of the STS soft starter and any other control from STS front touchscreen, switches, or Modbus interface will be overridden.								

4. Communication (continued)

4.4 Profibus DP

This module provides (part number: AB6213) Ethernet /IP network communications. The module has two RJ45 ports for daisy chain connection to multiple units.

Figure 4.4.1 Profibus DP Communication Module

The Ethernet /IP module is installed into the option module slot on the STS unit. See Appendix B for installation instructions.

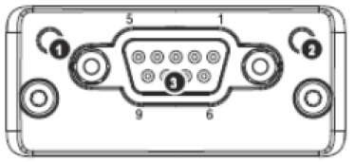
4.4.1 STS Configuration

STS will configure automatically when the module is detected.

4.4.2 Profibus DP Module Front Panel Indicators

Front panel

	Item
1	Operation mode
2	Status
3	Profibus network connector



Operation mode	
State	Indication
Off	No power or not inserted
Green	Online data exchange
Green, flashing	Network OK, no data exchange
Single Red flash	Parameter error
Double Red flash	Network error
Status	
State	Indication
Off	No power
Green	Initialised
Green, flashing	Initialised, Self testing
Red	Error

4. Communication (continued)

4.4.3 Profibus DP Module Pinout

Pin	Function
1	N/C
2	N/C
3	B line Positive RxD/TxD, RS485
4	RTS
5	Bus Ground (GND)
6	+5V Bus output termination power
7	N/C
8	A Line negative RxD/TxD, RS485
9	N/C

4.4.4 Profibus DP Control

The current Profibus interface for this device is specified in the GSD file. This contains the configuration required to run the synchronous standard telegram 1 allowing start/stop and fault monitoring of the STS unit.
The standard telegram consists of two 16 bit set-point words. The first being the drive control word.
This has the following functionality.

Output Word 1 (STW1)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Fault Reset	-	Unfreeze Ramp	Ramp On	Enable Operation	Coast Stop	-	Start
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
-	-	-	-	-	Network Connect	-	-

The second Probifbus Standard telegram 1 set-point word (NSOLL_A) is not implemented in this version so will not respond to set values.
The response telegram also consists of two words, this time values generated by the STS unit in response to the set-points. The first word holds status information and has the following meaning.

Input Word 1 (ZSW1)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	Switch on Inhibitied	Quick Stop Disabled	Same as Bit 0	Fault (Tripped)	Operation Enabled	Switched On	Ready Switch On
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Bit 1	-	-	-	-	-	Network Connected	-

4. Communication (continued)

As with the Outputs the second Probifbus Standard telegram 1 value word (NIST_A) is not implemented in this version so should be ignored.

4. Communication (continued)

4.5 Anybus Module Installation

1) Ensure that all power is removed from the STS™ soft starter prior to installing the option module.

2) Remove the blanking plate from the STS™ option module slot.

3) Carefully slide the communication module into the STS™ module slot applying slight downward force and forward pitch as shown in Fig 1. As the module moves into the STS™ unit, it will be necessary to reduce the pitch of the module Fig 2a and 2b. As the module approaches full insertion, apply slight downward pressure and push fully home Fig 3.

Figure 1

Figure 2a

Figure 2b

Figure 3

4) Ensure no gap is present between the module flange and the STS™ body.

5) Tighten the T9 screws to lock the module in place.

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5. Modbus RTU Parameter Table

Chapter 5

Address	Description	Min/Max/Default	Units	Read/ Write
Address: 128 (80 hex) Format: 8 bit unsigned Note: Binary value	**Firing Mode** Set to correspond with Unit connection to the Motor. Refer to connection diagrams in the Quick Start Guide. In-Line : The Unit is connected in-line with a delta or star connected motor. In-Delta : The Unit is connected inside the Delta of the motor. The iERS function is disabled	Min: 0 (0 hex) In-Line Max: 1 (1 hex) In-Delta Default: 0 (0 hex) In-Line		R/W
Address: 192 (C0 hex) Format: 8 bit unsigned Note: Binary value	**Legacy Delta Mode** Allows the Unit to be retro-fitted into "Delta" applications that previously used QFE / XFE (5MC) On : Operates in QFE / XFE (5MC) delta compatibility mode. Off : Operates normally. Refer to Unit Delta connection diagram in the Quick Start Guide.	Min: 0 (0 hex) Off Max: 1 (1 hex) On Default: 0 (0 hex) Off		R/W
Address: 320 (140 hex) Format: 8 bit unsigned Note: Binary value	**Kick Start** Applies a short duration torque pulse to dislodge 'sticky' loads On : The torque pulse is applied at start-up when complete the torque drops to the "Start Pedestal" Off: The initial starting torque is defined by the "Start Pedestal"	Min: 0 (0 hex) Off Max: 1 (1 hex) On Default: 0 (0 hex) Off		R/W
Address: 640 (280 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Kick Start Pedestal** Percentage of the supply voltage applied to the motor during the 'kick' period Increase to provide more torque If the load fails to break away. Decrease if the motor accelerates too quickly.	Min: 4915 (1333 hex) 30 Max:13107 (3333 hex) 80 Default: 12288 (3000 hex) 75	%	R/W
Address: 704 (2C0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Start Pedestal** Percentage of the supply voltage applied to motor at the beginning of the soft start. Increase to provide more torque If the load fails to break away. Decrease if the motor accelerates too quickly.	Min: 1638 (666 hex) 10 Max: 16384 (4000 hex) 100 Default: 3276 (CCC hex) 20	%	R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address: 768 (300 hex) Format: 16 bit unsigned Note:	**Rate End Start (3)** Adjusts the response of the "Automatic End Start (3)" Increase to provide a greater smoothing effect If there are torque fluctuations that occur during the soft start. When set to zero the smoothing is effectively disabled.	0 (0 hex) 0 16384 (4000 hex) 100 8192 (2000 hex) 50	%	R/W
Address: 96 (380 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Stop Pedestal** Percentage of the supply voltage applied to the motor at the end of the soft stop Increase if the motor crawls at the end of the soft stop. Decrease if a greater soft-stop effect is required at the end of the ramp.	1638 (666 hex) 10 6553 (1999 hex) 40 1638 (666 hex) 10	%	R/W
Address: 7040 (1B80 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1 ms)	**Kick Start Time** Time that the torque pulse is applied to load Increase to provide more torque If the load fails to break away. Decrease if the motor accelerates too quickly.	10 (A hex) 10 2000 (7D0 hex) 2000 100 (64 hex) 100	ms	R/W
Address: 7104 (1BC0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1 s)	**Start Time** Time taken to soft start from the "Start Pedestal" to the end of the start Normally set between 5 and 30 seconds. Actual time to get to full voltage depends on the "Start Current Limit Level". If set too long the motor can be at speed before the end of the time set. Refer to "Automatic End Start"	1 (1 hex) 1 300 (12C hex) 300 10 (A hex) 10	s	R/W
Address: 7296 (1C80 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1 s)	**Stop Time** The time taken to soft stop from full voltage or the iERS level to the 'Stop Pedestal' Normally set between 15 and 60 seconds. Actual time to get to 'Stop Pedestal' depends on the "Stop Current Limit Level". If set too long the motor may reach zero speed before the end of the time set. Refer to "Automatic End Stop"	0 (0 hex) 0 300 (12C hex) 300 0 (0 hex) 0	s	R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address: 8320 (2080 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1 ms)	**Contactor Delay** Time allowed for external contactors to close. Increase if contactors are driven by buffer relays or motor trips on phase loss when start signal applied Decrease if response to start signal needs to be improved	20 (14 hex) 20 800 (320 hex) 800 160 (A0 hex) 160	ms	R/W
Address: 8960 (2300 hex) Format: 8 bit unsigned Note:	**Analogue Output Type** Defines the physical function of the analogue output (AO) 0-10V : The output voltage varies from 0 to 10V 4-20mA : The output current varies from 4 to 20mA	0 (0 hex) 0 - 10V 1 (1 hex) 4 - 20mA 0 (0 hex) 0 - 10V		R/W
Address: 9024 (2340 hex) Format: 16 bit unsigned Note: 514=Imeasued, 522=Overload, 161=OverloadSCR, 542=Ptotal	**Select Function** Allows the Analogue output to be mapped to different PNU functions The output will change in proportion with the selected function By default the output will be at a maximum when the selected function equals its maximum value	0 (0 hex) Off 999 (3E7 hex) End of list 0 (0 hex) Off		R/W
Address:9088 (2380 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Scaling Level** Allows the selected function to be scaled The output will change in proportion with the selected function The output will be at a maximum when the selected function equals the "Scaling Level"	0 (0 hex) 0 16384 (4000 hex) Max value 0 (0 hex) 0	%	R/W
Address:9152 (23C0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1)	**Analogue Output Value** The value of the Analogue output The internal Digital to analogue converter is 10 bit.	0 (0 hex) 0 1024 (400 hex) 1024 0 (0 hex) 0		R
Address:9600 (2580 hex) Format: 8 bit unsigned Note: Binary value	**Analogue Input Type** Defines the function of the analogue input (AI) 0-10V : The input voltage varies from 0-10V 4-20mA : The input varies from 4 to 20mA	0 (0 hex) 0 - 10V 1 (1 hex) 4 - 20mA 0 (0 hex) 0 - 10V		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:9664 (25C0 hex) Format: 16 bit unsigned Note: 420=Current Limit Start, 431=I Shearpin, 441=I Overload	**Select Function** Allows the Analogue input to be mapped to different functions The selected function will change in proportion with the input By default the function will be at its maximum when the input is at it maximum	0 (0 hex) Off 999 (3E7 hex) End of list 0 (0 hex) Off		R/W
Address:9728 (2600 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Scaling Level** Allows the selected function to be scaled The selected function will change in proportion with the input The function will be at its "Scaling Level" when the input is at its maximum	0 (0 hex) 0 16384 (4000 hex) Max value 0 (0 hex) Max value	%	R/W
Address:9792 (2640 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1)	**Analogue Input Value** The value of the analogue Input The internal Analogue to Digital converter is 10 bit.	0 (0 hex) 0 1024 (400 hex) 1024 0 (0 hex) 0		R
Address:10432 (28C0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1)	**Motor Thermistor** Indicates the state of the Unit PTC input. Designed for single or double or triple PTC in series PTC thermistor standards DIN44081 / EN60738-1 apply (< 300R @ 25°C. Typically 4K @ nominal temperature) The value indicated is a not in degrees Celsius but is an internal representation. At 25°C the value displayed should be less than 100 and the Unit trips when value > 400 (open circuit = 1024) The value will increase rapidly when the motor thermistors approach their nominal temperature. If thermistors are connected the "Thermistor trip" should be turned "on"	0 (0 hex) 0 1024 (400 hex) 1024 0 (0 hex) 1024		R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:10944 (2AC0 hex) Format: 16 bit unsigned Note: 280=Start/Stop, 285=FreezeRamp, 287=Reset, 330=iErs,295=ExternalTrip	**Select Function** Allows the Digital input (D1-1I) to be mapped to different functions The selected function will change in proportion with the input Digital inputs can only be mapped if the "Control Method" is set to "User Programmable"	0 (0 hex) Off 999 (3E7 hex) End of list 280 (118 hex) Start/Stop		R/W
Address:10945 (2AC1 hex) Format: 16 bit unsigned Note: 280=Start/Stop, 285=FreezeRamp, 287=Reset, 330=iErs,295=ExternalTrip	**Select Function** Allows the Digital input (D1-2I) to be mapped to different functions The selected function will change in proportion with the input Digital inputs can only be mapped if the "Control Method" is set to "User Programmable"	0 (0 hex) Off 999 (3E7 hex) End of list 0 (0 hex) Off		R/W
Address:10946 (2AC2 hex) Format: 16 bit unsigned Note: 280=Start/Stop, 285=FreezeRamp, 287=Reset, 330=iErs,295=ExternalTrip	**Select Function** Allows the Digital input (D2-1I) to be mapped to different functions The selected function will change in proportion with the input Digital inputs can only be mapped if the "Control Method" is set to "User Programmable"	0 (0 hex) Off 999 (3E7 hex) End of list 287 (11F hex) Reset		R/W
Address:11584 (2D40 hex) Format: 16 bit unsigned Note: 581=Rdy,582=En,583=Error,588=Running, 590=EndOfStart,591=C/L, 595=iErsActive	**Select Function** Allows the Digital output (N/C (12)) to be mapped to different functions The output will change in proportion with the selected output	0 (0 hex) Off 999 (3E7 hex) End of list 583 Error		R/W
Address:11586 (2D42 hex) Format: 16 bit unsigned Note: 581=Rdy,582=En,583=Error,588=Running, 590=EndOfStart,591=C/L, 595=iErsActive	**Select Function** Allows the Digital output (N/0 (34)) to be mapped to different functions The output will change in proportion with the selected output	0 (0 hex) Off 999 (3E7 hex) End of list 588 Running		R/W
Address:11587 (2D43 hex) Format: 16 bit unsigned Note: 581=Rdy,582=En,583=Error,588=Running, 590=EndOfStart,591=C/L, 595=iErsActive	**Select Function** Allows the Digital output (N/0 (44)) to be mapped to different functions The output will change in proportion with the selected output	0 (0 hex) Off 999 (3E7 hex) End of list 590 End Of Start		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:12800 (3200 hex) Format: 8 bit unsigned Note: ASCII alpha numeric character Byte 7 (MSB)	**Serial Number** The device serial number stored at the point of manufacture	0 (0 hex) 0 255 (FF hex) 255 Not Applicable		R
Address:12801 (3201 hex) Format: 8 bit unsigned Note: ASCII alpha numeric character Byte 6	**Serial Number** The device serial number stored at the point of manufacture	0 (0 hex) 0 255 (FF hex) 255 Not Applicable		R
Address:12802 (3202 hex) Format: 8 bit unsigned Note: ASCII alpha numeric character Byte 5	**Serial Number** The device serial number stored at the point of manufacture	0 (0 hex) 0 255 (FF hex) 255 Not Applicable		R
Address:12803 (3203 hex) Format: 8 bit unsigned Note: ASCII alpha numeric character Byte 4	**Serial Number** The device serial number stored at the point of manufacture	0 (0 hex) 0 255 (FF hex) 255 Not Applicable		R
Address:12804 (3204 hex) Format: 8 bit unsigned Note: ASCII alpha numeric character Byte 3	**Serial Number** The device serial number stored at the point of manufacture	0 (0 hex) 0 255 (FF hex) 255 Not Applicable		R
Address:12805 (3205 hex) Format: 8 bit unsigned Note: ASCII alpha numeric character Byte 2	**Serial Number** The device serial number stored at the point of manufacture	0 (0 hex) 0 255 (FF hex) 255 Not Applicable		R
Address:12806 (3206 hex) Format: 8 bit unsigned Note: ASCII alpha numeric character Byte 1	**Serial Number** The device serial number stored at the point of manufacture	0 (0 hex) 0 255 (FF hex) 255 Not Applicable		R
Address:12807 (3207 hex) Format: 8 bit unsigned Note: ASCII alpha numeric character Byte 0	**Serial Number** The device serial number stored at the point of manufacture	0 (0 hex) 0 255 (FF hex) 255 Not Applicable		R
Address:12864 (3240 hex) Format: 8 bit unsigned Note: ASCII alpha numeric character Byte 3 (MSB)	**Passcode** Stops unauthorised access to read/ write parameters For the passcode be active, the "Screen lock" must be turned on	48 (30 hex) 0 57 (39 hex) Max Value 48 (30 hex) 0		R/W
Address:12865 (3241 hex) Format: 8 bit unsigned Note: ASCII alpha numeric character Byte 2	**Passcode** Stops unauthorised access to read/ write parameters For the passcode be active, the "Screen lock" must be turned on	48 (30 hex) 0 57 (39 hex) Max Value 48 (30 hex) 0		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:12866 (3242 hex) Format: 8 bit unsigned Note: ASCII alpha numeric character Byte 1	**Passcode** Stops unauthorised access to read/ write parameters For the passcode to be active the "Screen lock" must be turned on	48 (30 hex) 0 57 (39 hex) Max Value 48 (30 hex) 0		R/W
Address:12867 (3243 hex) Format: 8 bit unsigned Note: ASCII alpha numeric character Byte 0	**Passcode** Stops unauthorised screen access to read/ write parameters For the passcode to be active the "Screen lock" must be turned on	48 (30 hex) 0 57 (39 hex) Max Value 48 (30 hex) 0		R/W
Address:12928 (3280 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1)	**Model Number** The device Model number stored at the point of manufacture	0 (0 hex) 0 65535 (FFFF hex) Max Value Not Applicable		R
Address:12992 (32C0 hex) Format: 8 bit unsigned Note: Binary value	**Screen Lock** Stops unauthorised access to read/ write parameters	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:13120 (3340 hex) Format: Note:	**Service Code** Diagnostic parameter For SIT Automation use only			
Address:13184 (3380 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1)	**Software Version (PCB2)** Software Version for the Main control PCB. Software version recorded in log file	0 (0 hex) 0 4294967295 (FFFFFFFF hex) Max Value Not Applicable		R
Address:13248 (33C0 hex) Format: 8 bit unsigned Note: Binary value	**Date Format** Allows the date format to be changed dd/mm/yyyy or mm/dd/yyyy	0 (0 hex) dd/mm/yyyy 1 (1 hex) mm/dd/yyyy 0 (0 hex) dd/mm/yyyy		R/W
Address:13312 (3400 hex) Format: 8 bit unsigned Note: Binary value	**Temperature Format** Selects °C or °F for displayed temperatures °C : All displayed temperatures are °C °F : All displayed temperatures are °F	0 (0 hex) °C 1 (1 hex) °F 0 (0 hex) °C		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:13376 (3440 hex) Format: 16 bit unsigned Note: 1=ENG, 2=DEU, 3=FRA, 4=ITA, 5=CHN, 6=TUR, 7=POR, 8=JPN, 9=SRB, 10=RUS, 11=VNM, 12=KOR, 13=ESP	**Language** Selects the display language for the keypad Enter the required language from the displayed list	1 (1 hex) English 10 (A hex) End of list 1 (1 hex) English		R/W
Address:14080 (3700 hex) Format: 8 bit unsigned Note: Binary value	**Traffic LEDS** Allows the user to check the state of the modbus communication network. Red LED receive. Green LED Transmit. On : The Red and Green LEDS display the traffic on the Modbus communications network Off : The Red and Green LEDs display the Unit status information	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:14144 (3740 hex) Format: 8 bit unsigned Note: Binary value	**Main Contactor Control** The unit is configured to start and stop when the main contactor opens and closes. On : When a zero stop time is set some faults will be ignored when main conatctor opens Off : The unit may trip when the main contcator opens	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:14208 (3780 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1 s)	**Backlight Timeout** Time for backlight on display After the period set the back light on the screen will turn off To reactivate touch screen anywhere. To disable set to 0	0 (0 hex) 0 3600 (E10 hex) 3600 60 (3C hex) 60	s	R/W
Address:14720 (3980 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Time** Allows the time to be changed to 'local' time By default the time is set to GMT	- - GMT time	hh:mm:ss	R/W
Address:15808 (3DC0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1 ms)	**Timeout ms** Communications trip Timeout period To prevent a 'Communications Trip' (If enabled) the bus must be kept active. To keep the bus active there must be at least one Modbus read or write (any PNU) during the "Timeout ms" period	0 (0 hex) 0 60000 (EA60 hex) 60000 5000 (1388 hex) 5000	ms	R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:16000 (3E80 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1)	**Address** Sets the Modbus station number	1 (1 hex) 1 32 (20 hex) 32 1 (1 hex) 1		R/W
Address:16064 (3EC0 hex) Format: 16 bit unsigned Note: 0=9600, 1=19200, 2=38400, 3=57600, 4=115200	**Baud Rate** Sets the serial communications baud rate The available baud rates are 9600 19200 38400 57600 or 115200	0 (0 hex) 9600 4 (4 hex) 115200 1 (1 hex) 19200		R/W
Address:16128 (3F00 hex) Format: 16 bit unsigned Note: 0=None, 1=Even, 2=Odd	**Parity** Sets the serial communications parity bit The available parity options are None Even Odd Also sets the stop bits. No parity uses 2 stop bits. Odd or even parity uses 1 stop bit	0 (0 hex) None 2 (2 hex) Odd 1 (1 hex) Even		R/W
Address:17920 (4600 hex) Format: 8 bit unsigned Note: Binary value	**Start/Stop** CONTROL COMMAND : Start / Stop On : Starts the Unit Off : Stops or Soft stops the Unit To map to digital input refer to PNU10944-PNU10946	0 (0 hex) (Soft) Stop 1 (1 hex) Start 0 (0 hex) (Soft) Stop		R/W
Address:18240 (4740 hex) Format: 8 bit unsigned Note: Binary value	**Freeze Ramp** CONTROL COMMAND : Freeze Ramp On : The Soft Start Ramp is held and the Unit will take longer than the time set to start Off : The Soft Start Ramp is not held and the Unit will start in the time set. If set to On this parameter will hold the Start Ramp even if "Current Irms" is less than the "Current Limit Level" To map to digital input refer to PNU10944-PNU10946	Min: 0 (0 hex) Off Max: 1 (1 hex) On Default: 0 (0 hex) Off		R/W
Address:18368 (47C0 hex) Format: 8 bit unsigned Note: Binary value	**Reset** CONTROL COMMAND : Reset On : The initial state required for a reset. Off : The final state required for a reset. To reset pulse high and then low To map to digital input refer to PNU10944-PNU10946	Min: 0 (0 hex) Off Max: 1 (1 hex) On Default: 0 (0 hex) Off		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:18880 (49C0 hex) Format: 8 bit unsigned Note: Binary value	**External Trip** CONTROL COMMAND : External Trip On : If "External Trip" is enabled the Unit trips Off : The Unit will not trip Ensure start signal is low before reset. To map to digital input refer to PNU10944-PNU10946	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:19200 (4B00 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1)	**Application:** The Unit has numerous preset applications built in as standard. Select the application best suited to the load. The selected application will automatically change several parameters and functions. Depending on the application loaded the "Trip Class" may also change Refer to the separate 'applications document' for more details	0 (0 hex) Default 65535 (FFFF hex) End of list 0 (0 hex) Default		R/W
Address:19840 (4D80 hex) Format: 8 bit unsigned Note: Binary value	**Automatic Pedestal** Automatically controls the starting torque On : The initial torque is increased until the motor starts to rotate at a moderate speed. Off: The initial torque is defined by the "Start Pedestal"	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:19904 (4DC0 hex) Format: 8 bit unsigned Note: Binary value	**Automatic End Start (2)** Automatically controls the time taken for the motor to start On : The ramp time is shortened if the motor current falls below the current limit level before the end of the "Start Time". Off: The ramp time depends on the "Start Time" and "Current Limit"	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:19968 (4E00 hex) Format: 8 bit unsigned Note: Binary value	**Automatic End Start (1)** Automatically controls the time taken for the motor to start On : The ramp time is shortened if the motor is at speed before the end of the "Start Time" Off: The ramp time depends on the "Start Time" and "Current Limit"	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:20032 (4E40 hex) Format: 8 bit unsigned Note: Binary value	**Automatic End Start (3)** Automatically controls the time taken for the motor to start On : The ramp time is shortened if torque fluctuations occur before the end of the "Start Time" Off: The ramp time depends on the "Start Time" and "Current Limit"	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:20160 (4EC0 hex) Format: 8 bit unsigned Note: Binary value	**Automatic Stop** Automatically controls the soft stop to suit the application. This feature is particularly useful with pumping applications On : If the motor is lightly loaded it decelerates rapidly to the point where the soft stop becomes useful.	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:20224 (4F00 hex) Format: 8 bit unsigned Note: Binary value	**Auto Smooth Stop** Automatically controls the soft stop to eliminate oscillations that can occur towards the end of the ramp On : The soft stop is adjusted when oscillations are detected. Refer to "Auto smoothing Level" Off : The soft stop is unadjusted and torque fluctuations may cause instability. This can often occur in pumping applications	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:20352 (4F80 hex) Format: 8 bit unsigned Note: Binary value	**Automatic Ramp** Automatically controls the torque applied to the motor during the soft start. On : The torque is adjusted to suit the load. Off: The ramp time depends on the "Start Time" and "Current Limit"	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:20416 (4FC0 hex) Format: 8 bit unsigned Note: Binary value	**Automatic End Stop** Automatically controls the "Stop Time" On : The ramp time is shortened if the motor reaches a very low speed before the end of the "Stop Time" Off: The ramp time " depends on the "Stop Time" and "Current Limit"	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:20480 (5000 hex) Format: 8 bit unsigned Note: Binary value	**Automatic Impact Load** Automatically controls the maximum iERS saving level. On : The maximum iERS saving level ("BackStop") is reset to maximum during each load cycle. Off : The saving potential may be reduced on applications with heavy load cycles. Such as injection moulding machines.	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:20608 (5080 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Automatic Stop Profile** Adjusts the response of the "Automatic Stop" Increase if the motor speed doesn't drop quickly enough. When the value is set to zero the "Automatic Stop" is effectively disabled	0 (0 hex) 0 16384 (4000 hex) 100 8192 (2000 hex) 50	%	R/W
Address:20672 (50C0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Auto Smoothing Level** Adjusts the response of the "Automatic smoothing" Increase to provide a greater smoothing effect If there are torque fluctuations that occur during the soft stop. When set to zero the smoothing is effectively disabled.	1638 (666 hex) 10 16384 (4000 hex) 100 8192 (2000 hex) 50	%	R/W
Address:21120 (5280 hex) Format: 8 bit unsigned Note: Binary value	**iERS** Enables and disables the intelligent Energy Recovery System feature (iERS). On : The voltage to the motor will be regulated to ensure optimum efficiency. Off : The feature is disabled and the motor operates at full voltage	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:21184 (52C0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**iERS Rate** Determines the rate at which the load is regulated during the iERS energy saving mode During periods of instability the "Current Irms" and "True Power Factor" will oscillate rapidly. Increase if the applications shows signs of instability. Reduce to increase the speed of response	0 (0 hex) 0 16384 (4000 hex) 100 4096 (1000 hex) 25	%	R/W
Address:21320 (5348 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Start Saving Level** The current in Amps at which the iERS is enabled or disabled. The iERS function is active when the motor current is less than the "Start Saving Level" When the iERS function is disabled internal bypass relays close to improve efficiency.	8192 (2000 hex) 50% I-motor 13107 (3333 hex) 80% I-motor 13107 (3333 hex) 80% I-motor		R
Address:21376 (5380 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**iERS Level** Determines the maximum energy saving potential. Reduce if the application shows signs of instability. The amount of energy that can be saved may fall as the "iERS level" is reduced.	0 (0 hex) 0 16384 (4000 hex) 100 16384 (4000 hex) 100	%	R/W
Address:21760 (5500 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1° of mains cycle) Time(ms)=(Value/PNU32000)*(25/9)	**Ref PF Degrees** The Reference Power Factor used by the iERS saving function This is the target Power Factor for the iERS saving function. The parameter will change dynamically dependant on motor operation The parameter displays the displacement part of the True Power Factor and is used for diagnostic purposes.	0 (0 hex) 0 90 (5A hex) 90 0 (0 hex) 0	Degrees	R
Address:21824 (5540 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1° of mains cycle) Time(ms)=(Value/PNU32000)*(25/9)	**Pres PF Degrees** The Present Power Factor used by the iERS saving function This is the actual Power Factor for the iERS saving function. The "Delay" is constantly adjusted to minimise the control loop error between "Pres PF Degrees" and "Ref PF Degrees" The parameter displays the displacement part of the True Power Factor and is used for diagnostic purposes.	0 (0 hex) 0 90 (5A hex) 90 0 (0 hex) 0	Degrees	R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:22400 (5780 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1° of mains cycle) Time(ms)=(Value/PNU32000)*(25/9)	**Delay Angle** Internal firing delay angle in Degrees Displayed for diagnostic purposes	0 (0 hex) 0 60 (3C hex) 60 0 (0 hex) 0	Degrees	R
Address:22464 (57C0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1° of mains cycle) Time(ms)=(Value/PNU32000)*(25/9)	**Delay Max** The maximum possible delay for iERS saving Displayed for diagnostic purposes	0 (0 hex) 0 55 (37 hex) 55 0 (0 hex) 0	Degrees	R
Address:23040 (5A00 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1° of mains cycle) Time(ms)= (Value/PNU32000)*(25/9)	**BackStop** The maximum possible Delay angle for the current iERS saving phase Displayed for diagnostic purposes May decrease during heavy load periods or instability	0 (0 hex) 0 55 (37 hex) 55 0 (0 hex) 0	Degrees	R
Address:25600 (6400 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**i-rated** Unit Class20 / Class30 Current Rating	17000 (4268 hex) 17 2000000 (1E8480 hex) 2000 17000 (4268 hex) 17	A	R
Address:25664 (6440 hex) Format: 16 bit unsigned Note: 10= Trip Class 10, 20 = Trip Class 20, 30 = Trip Class 30	**Trip Class** The trip class is a numeric value that correlates the trip time with overload level. Select Trip class according to application requirements The trip time depends on the selected Trip Class. The duration of the overload and the level of the over current. Refer to the Motor Overload 'cold' trip curves on Page 25. When "Class 20" or "Class30" are selected the Unit current rating (i-Unit) will be reduced to a lower value (i-rated).	10 (A hex) Trip Class 10 30 (1E hex) Trip Class 30 10 (A hex) Trip Class 10		R/W
Address:25728 (6480 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Motor Current** This should be set to the Full Load Current shown on the motor plate The overload works with multiples of the set "Motor Current" (i-motor) Also referred to as Motor FLA	(0.5 x PNU25600) 50% I-rated (1 x PNU25600) 100% I-rated (1 x PNU25600) 100% I-rated	A	R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:25792 (64C0 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**i-STS** Unit Class10 Current Rating	17000 (4268 hex) 17 2000000 (1E8480 hex) 2000 17000 (4268 hex) 17	A	R
Address:26304 (66C0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Low Current Trip Level** The current in Amps that will cause a trip A trip will occur if the motor current is less than the "Trip Level" for the "Trip Time"	(0.25 x PNU25728) 25% I-motor (1 x PNU25728) 100% I-motor (0.25 x PNU25728) 25% I-motor	A	R/W
Address:26368 (6700 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1 ms)	**Low Current Trip Time** The trip time for the Low current trip A trip will occur if the motor current is less than the "Trip Level" for the "Trip Time"	100 (64 hex) 100 9000 (2328 hex) 9000 100 (64 hex) 100	ms	R/W
Address:26880 (6900 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Start Current Limit Level** The current in Amps at which the soft Start ramp is held. Normally set to 350% of motor FLC. Increase if motor fails to accelerate at required rate The "Current Limit Level" will effect actual time to start. If set too low the motor may not accelerate to full speed.	(0.5 x PNU25728) 50% I-motor (4.5 x PNU25792) 450% I-STS (3.5 x PNU25728) 350% I-motor	A	R/W
Address:26944 (6940 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1 s)	**Start Current Limit Time** The maximum time allowed for the current limit. If the current limit is still active at the end of this period the Unit will either 'Trip' or 'continue'	1 (1 hex) 1 600 (258 hex) 600 30 (1E hex) 30	s	R/W
Address:27584 (6BC0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Shearpin Trip Current** The current in Amps that will cause a "Shearpin Trip" A trip will occur if the motor current is greater than the "Trip Level" for the "Trip Time"	(1 x PNU25728) 100% I-motor (4.5 x PNU25792) 450% I-STS (4.5 x PNU25792) 450% I-STS	A	R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:27648 (6C00 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1 ms)	**Shearpin Trip Time** The trip time for the Shearpin trip A trip will occur if the motor current is greater than the "Trip Level" for the "Trip Time"	100 (64 hex) 100 9000 (2328 hex) 9000 100 (64 hex) 100	ms	R/W
Address:28224 (6E40 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Overload Level** Determines the level in Amps at which the overload will start. Normally set to 115% of the set motor current (i-motor) Reduce to speed up trip response	(0.5 x PNU25728) 50% I-motor (4.5 x PNU25792) 125% I-motor (1.15 x PNU25728) 115% I-motor	A	R/W
Address:28800 (7080 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Stop Current Limit Level** The current in Amps at which the soft stop ramp is not allowed to go above. Normally set to 350% motor FLC. Increase if motor decelerates too rapidly. The current limit level will effect actual time to stop the motor.	(1 x PNU25728) 100% I-motor (4.5 x PNU25792) 450% I-STS (3.5 x PNU25728) 350% I-motor	A	R/W
Address:28864 (70C0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1 s)	**Stop Current Limit Time** The maximum time allowed for the current limit. If the current limit is still active at the end of this period the Unit will either trip or continue	1 (1 hex) 1 300 (12C hex) 300 10 (A hex) 10	s	R/W
Address:32000 (7D00 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = mHz) Freq(Hz) = (Value / 1000)	**Line Frequency** The frequency of the 3-phase supply	45000 (AFC8 hex) 45 65000 (FDE8 hex) 65 Not Applicable -	Hz	R
Address:32064 (7D40 hex) Format: 16 bit unsigned Note: Binary value	**Phase Rotation** Indicates the phase sequence of the incoming supply. RYB = L1-L2-L3 RBY = L1-L3-L2	0 (0 hex) L1-L2-L3 1 (1 hex) L1-L3-L2 0 (0 hex) L1-L2-L3		R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:32896 (8080 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Current Irms** The RMS motor current This is the maximum of the 3 phases. This value is used for the overload and power calculations	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:32960 (80C0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1 V)	**Vrms (Approx)** The RMS 3-phase supply voltage. This is the average of the 3 phases. This value is used for power calculations This value is derived internally. If a higher level of accuracy is required a "Fixed Voltage" value can be used.	0 (0 hex) 0 500 (1F4 hex) 500 0 (0 hex) 0	V	R
Address: 33024 (8100 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.001)	**True Power Factor** The True Power Factor The True Power Factor = (Displacement Power Factor x Distortion Power Factor)	0 (0 hex) 0 1000 (3E8 hex) 1 0 (0 hex) 0		R
33408 8280 33408 (8280 hex) 522	**Overload** The Unit has an "Overload" function that is an electronic equivalent to a thermal overload. "Overload" displays the overload capacity which is a measure of how close the Unit to tripping on "Overload Trip" When "Current Irms" is greater than the "Overload Level" the "Overload" increases in accordance with the "Trip Class". When "Current Irms" is less than "Overload Level" the "Overload" decreases exponentially (if greater than 50%) When the "Overload" reaches 100% the Unit will trip. During situations when (i-motor) is equal to (i-Unit) the overload will indicate 50%	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:33536 (8300 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**I1** The RMS current on phase L1	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:33538 (8302 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**I2** The RMS current on phase L2	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:33540 (8304 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**I3** The RMS current on phase L3	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:34688 (8780 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1W) True Power (KW) = (Value / 1000)	**True Power P** Total true power This is an addition of the 3 phases	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	kW	R
Address:34816 (8800 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1VA) Apparent Power (kVA) = (Value/1000)	**Apparent Power S** Total Apparent Power This is an addition of the 3 phases	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	kVA	R
Address:34944 (8880 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1Var) Reactive Power (kVar) = (Value / 1000)	**Reactive Power Q** Total Reactive power This is an addition of the 3 phases	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	kvar	R
Address:35008 (88C0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**iERS Saving Level** Indicates the level of potential saving 100% indicates that Unit is saving at its maximum level	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R
Address:35200 (8980 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 1 V)	**Fixed Voltage** User settable voltage level for power calculations If required can be used to improve accuracy of power calculations	100 (64 hex) 100 500 (1F4 hex) 500 500 (1F4 hex) 100	V	R/W
Address:35264 (89C0 hex) Format: 8 bit unsigned Note: Binary value	**Fixed Voltage** Selects the source for the voltage value used in the power calculations. on: KW KVar and KVA are calculated using the "Fixed Voltage" off: KW KVar and KVA are calculated using the internally measured voltage.	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:35840 (8C00 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1)	**Number of Starts** The total number of successful starts	0 (0 hex) 0 4294967295 (FFFFFFFF hex) 4294836225 0 (0 hex) 0		R
Address:36544 (8EC0 hex) Format: 16 bit (Highbyte=b11-b8, LowByte=b7-b0) Ta >= 0 b12=0 Ta < 0 b12=1 Note: bit12=0 [HighByte*16 + LowByte/16] bit12=1 256-[HighByte*16 + LowByte/16]	**HeatSink Temp** The temperature of the internal Unit heatsink. The Unit will trip when the heatsink temperature exceeds 80°C. The internal cooling fans will turn on if this temperature exceeds 40°C	7872 (1EC0 hex) -20 1280 (500 hex) 80 Not Applicable	°C	R
Address:37184 (9140 hex) Format: 8 bit unsigned Note: Binary value	**Ready** STATUS INDICATION : Ready On : Indicates that the Unit is healthy and ready for a start. Remains on when Running Off : The Unit has not powered up successfully or failed to reset from a trip To map to digital output refer to PNU11584-PNU11587	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R
Address:37248 (9180 hex) Format: 8 bit unsigned Note: Binary value	**Enabled** STATUS INDICATION : Enabled On : Indicates that the Unit is enabled and the motor is being controlled. Remains on when Running Off : The Unit has detected a fault and tripped To map to digital output refer to PNU11584-PNU11587	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R
Address:37312 (91C0 hex) Format: 8 bit unsigned Note: Binary value	**Error** STATUS INDICATION : Error On : Indicates that the Unit has detected a fault and has shut down. Off : The Unit is fault free The fault must be cleared before a reset To map to digital output refer to PNU11584-PNU11587	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:37632 (9300 hex) Format: 8 bit unsigned Note: Binary value	**Running** STATUS INDICATION : Running On : Indicates that the unit has been given a run command and the motor is being controlled. Off : The Unit has detected a fault and tripped To map to digital output refer to PNU11584-PNU11587	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R
Address:37760 (9380 hex) Format: 8 bit unsigned Note: Binary value	**End Of Start** STATUS INDICATION : End Of Start On : Indicates that the Soft Start ramp has been completed. Off : The Unit is disabled or ramping down. To map to digital output refer to PNU11584-PNU11587	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R
Address:37824 (93C0 hex) Format: 8 bit unsigned Note: Binary value	**Current Limit** STATUS INDICATION : Current Limit On : The ramp is being held because "Current Irms" is greater or equal to " Current Limit Level " Off : The ramp is not being held because " Current Irms " is less than " Current Limit Level " To map to digital output refer to PNU11584-PNU11588	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R
Address:38080 (94C0 hex) Format: 8 bit unsigned Note: Binary value	**iERS Active** STATUS INDICATION : iERS Active On : Indicates that the Unit is operating in the iERS energy saving Mode. Off : The iERS saving mode has been disabled either internally or via ModbusPNU 21120 To map to digital output refer to PNU11584-PNU11587	0 (0 hex) 0 1 (1 hex) 1 0 (0 hex) 0		R
Address:38400 (9600 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last Peak Current** Displays the peak current of the last successful start.	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:38402 (9602 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak start current -1** Displays the peak current of the last successful start -1	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:38404 (9604 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak start current -2** Displays the peak current of the last successful start -2	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:38406 (9606 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak start current -3** Displays the peak current of the last successful start -3	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:38408 (9608 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak start current -4** Displays the peak current of the last successful start -4	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:38410 (960A hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak start current -5** Displays the peak current of the last successful start -5	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:38412 (960C hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak start current -6** Displays the peak current of the last successful start -6	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:38414 (960E hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak start current -7** Displays the peak current of the last successful start -7	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:38416 (9610 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak start current -8** Displays the peak current of the last successful start -8	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:38418 (9612 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak start current -9** Displays the peak current of the last successful start -9	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:38464 (9640 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak start current / Last** Temperature / Last Overload (Time) Displays the event time	- - GMT time	hh:mm:ss	R
Address:38467 (9643 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak start current / Last** Temperature / Last Overload -1 (Time) Displays the event time	- - GMT time	hh:mm:ss	R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write

Address:38470 (9646 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak start current / Last** Temperature / Last Overload -2 (Time) Displays the event time	- - GMT time	hh:mm:ss	R
Address:38473 (9649 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak start current / Last** Temperature / Last Overload -3 (Time) Displays the event time	- - GMT time	hh:mm:ss	R
Address:38476 (964C hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak start current / Last** Temperature / Last Overload -4 (Time) Displays the event time	- - GMT time	hh:mm:ss	R
Address:38479 (964F hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak start current / Last** Temperature / Last Overload -5 (Time) Displays the event time	- - GMT time	hh:mm:ss	R
Address:38482 (9652 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak start current / Last** Temperature / Last Overload -6 (Time) Displays the event time	- - GMT time	hh:mm:ss	R
Address:38485 (9655 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak start current / Last** Temperature / Last Overload -7 (Time) Displays the event time	- - GMT time	hh:mm:ss	R
Address:38488 (9658 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak start current / Last** Temperature / Last Overload -8 (Time) Displays the event time	- - GMT time	hh:mm:ss	R
Address:38491 (965B hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak start current / Last** Temperature / Last Overload -9 (Time) Displays the event time	- - GMT time	hh:mm:ss	R
Address:39040 (9880 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak stop current** Displays the peak current of the last successful stop	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:39042 (9882 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak stop current -1** Displays the peak current of the last successful stop -1	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:39044 (9884 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak stop current -2** Displays the peak current of the last successful stop -2	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:39046 (9886 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak stop current -3** Displays the peak current of the last successful stop -3	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:39048 (9888 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak stop current -4** Displays the peak current of the last successful stop -4	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:39050 (988A hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak stop current -5** Displays the peak current of the last successful stop -5	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:39052 (988C hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak stop current -6** Displays the peak current of the last successful stop -6	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:39054 (988E hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak stop current -7** Displays the peak current of the last successful stop -7	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:39056 (9890 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak stop current -8** Displays the peak current of the last successful stop -8	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:39058 (9892 hex) Format: 32 bit unsigned Note: Linear Scaling (1 = 1mA) Current (A) = (Value / 1000)	**Last peak stop current -9** Displays the peak current of the last successful stop -9	0 (0 hex) 0 10000000 (989680 hex) 10000 0 (0 hex) 0	A	R
Address:39104 (98C0 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak stop current (Time)** Displays the event time	- - GMT time	hh:mm:ss	R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:39107 (98C3 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak stop current -1 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:39110 (98C6 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak stop current -2 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:39113 (98C9 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak stop current -3 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:39116 (98CC hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak stop current -4 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:39119 (98CF hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak stop current -5 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:39122 (98D2 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak stop current -6 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:39125 (98D5 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak stop current -7 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:39128 (98D8 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak stop current -8 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:39131 (98DB hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last peak stop current -9 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:39680 (9B00 hex) Format: 16 bit (Highbyte=b11-b8, LowByte=b7-b0) Ta >= 0 b12=0 Ta < 0 b12=1 Note: bit12=0 [HighByte*16 + LowByte/16] bit12=1 256-[HighByte*16 + LowByte/16]	**Last temperature** Displays the heatsink temperature at the end of the last successful start	7872 (1EC0 hex) -20 1280 (500 hex) 80 Not Applicable	°C	R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:39681 (9B01 hex) Format: 16 bit (Highbyte=b11-b8, LowByte=b7-b0) Ta >= 0 b12=0 Ta < 0 b12=1 Note: bit12=0 [HighByte*16 + LowByte/16] bit12=1 256-[HighByte*16 + LowByte/16]	**Last temperature -1** Displays the heatsink temperature at the end of the last successful start -1	7872 (1EC0 hex) -20 1280 (500 hex) 80 Not Applicable	°C	R
Address:39682 (9B02 hex) Format: 16 bit (Highbyte=b11-b8, LowByte=b7-b0) Ta >= 0 b12=0 Ta < 0 b12=1 Note: bit12=0 [HighByte*16 + LowByte/16] bit12=1 256-[HighByte*16 + LowByte/16]	**Last temperature -2** Displays the heatsink temperature at the end of the last successful start -2	7872 (1EC0 hex) -20 1280 (500 hex) 80 Not Applicable	°C	R
Address:39683 (9B03 hex) Format: 16 bit (Highbyte=b11-b8, LowByte=b7-b0) Ta >= 0 b12=0 Ta < 0 b12=1 Note: bit12=0 [HighByte*16 + LowByte/16] bit12=1 256-[HighByte*16 + LowByte/16]	**Last temperature -3** Displays the heatsink temperature at the end of the last successful start-3	7872 (1EC0 hex) -20 1280 (500 hex) 80 Not Applicable	°C	R
Address:39684 (9B04 hex) Format: 16 bit (Highbyte=b11-b8, LowByte=b7-b0) Ta >= 0 b12=0 Ta < 0 b12=1 Note: bit12=0 [HighByte*16 + LowByte/16] bit12=1 256-[HighByte*16 + LowByte/16]	**Last temperature -4** Displays the heatsink temperature at the end of the last successful start-4	7872 (1EC0 hex) -20 1280 (500 hex) 80 Not Applicable	°C	R
Address:39685 (9B05 hex) Format: 16 bit (Highbyte=b11-b8, LowByte=b7-b0) Ta >= 0 b12=0 Ta < 0 b12=1 Note: bit12=0 [HighByte*16 + LowByte/16] bit12=1 256-[HighByte*16 + LowByte/16]	**Last temperature -5** Displays the heatsink temperature at the end of the last successful start-5	7872 (1EC0 hex) -20 1280 (500 hex) 80 Not Applicable	°C	R
Address:39686 (9B06 hex) Format: 16 bit (Highbyte=b11-b8, LowByte=b7-b0) Ta >= 0 b12=0 Ta < 0 b12=1 Note: bit12=0 [HighByte*16 + LowByte/16] bit12=1 256-[HighByte*16 + LowByte/16]	**Last temperature -6** Displays the heatsink temperature at the end of the last successful start-6	7872 (1EC0 hex) -20 1280 (500 hex) 80 Not Applicable	°C	R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:39687 (9B07 hex) Format: 16 bit (Highbyte=b11-b8, LowByte=b7-b0) Ta >= 0 b12=0 Ta < 0 b12=1 Note: bit12=0 [HighByte*16 + LowByte/16] bit12=1 256-[HighByte*16 + LowByte/16]	**Last temperature -7** Displays the heatsink temperature at the end of the last successful start-7	7872 (1EC0 hex) -20 1280 (500 hex) 80 Not Applicable	°C	R
Address:39688 (9B08 hex) Format: 16 bit (Highbyte=b11-b8, LowByte=b7-b0) Ta >= 0 b12=0 Ta < 0 b12=1 Note: bit12=0 [HighByte*16 + LowByte/16] bit12=1 256-[HighByte*16 + LowByte/16]	**Last temperature -8** Displays the heatsink temperature at the end of the last successful start-8	7872 (1EC0 hex) -20 1280 (500 hex) 80 Not Applicable	°C	R
Address:39689 (9B09 hex) Format: 16 bit (Highbyte=b11-b8, LowByte=b7-b0) Ta >= 0 b12=0 Ta < 0 b12=1 Note: bit12=0 [HighByte*16 + LowByte/16] bit12=1 256-[HighByte*16 + LowByte/16]	**Last temperature -9** Displays the heatsink temperature at the end of the last successful start-9	7872 (1EC0 hex) -20 1280 (500 hex) 80 Not Applicable	°C	R
Address:40320 (9D80 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Last overload** Displays the overload level at the end of the last successful start	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R
Address:40321 (9D81 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Last overload-1** Displays the overload level at the end of the last successful start -1	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R
Address:40322 (9D82 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Last overload-2** Displays the overload level at the end of the last successful start -2	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R
Address:40323 (9D83 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Last overload-3** Displays the overload level at the end of the last successful start -3	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R
Address:40324 (9D84 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Last overload-4** Displays the overload level at the end of the last successful start -4	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:40325 (9D85 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Last overload-5** Displays the overload level at the end of the last successful start -5	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R
Address:40326 (9D86 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Last overload-6** Displays the overload level at the end of the last successful start -6	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R
Address:40327 (9D87 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Last overload-7** Displays the overload level at the end of the last successful start -7	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R
Address:40328 (9D88 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Last overload-8** Displays the overload level at the end of the last successful start -8	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R
Address:40329 (9D89 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Last overload-9** Displays the overload level at the end of the last successful start -9	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R
Address:44864 (AF40 hex) Format: 16 bit unsigned Note: Linear Scaling (1 = 0.006104 %)	**Trip Sensitivity** Adjusts the reaction time to fault trips Increase "Trip Sensitivity" to slow the response to fault trips. Sometimes useful on sites were electrical noise is causing nuisance tripping Increasing "Trip Sensitivity" will slow the response of all the trips.	0 (0 hex) 0 16384 (4000 hex) 100 0 (0 hex) 0	%	R/W
Address:53762 (D202 hex) Format: 8 bit unsigned Note: Binary value	**Input Side Phase Loss** Detects if there is a disconnection between the Unit input and the supply when the motor is running. On : Trips if there is a disconnection between the input side of the Unit and the supply when the motor is running. Off : The Unit will attempt to run although the operation may be erratic. Operating in this mode for prolonged periods may result in SCR failure	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:53768 (D208 hex) Format: 8 bit unsigned Note: Binary value	**Thermal Sensor Trip** Detects if the internal temperature sensor has malfunctioned On : The Unit will trip if the internal temperature sensor malfunctions Off : The Unit will continue to operate even if the temperature sensor has malfunctioned. Operating in this mode for prolonged periods may result in SCR failure	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W
Address:53769 (D209 hex) Format: 8 bit unsigned Note: Binary value	**Shut Down (1)** This features controls the soft stop improve stability On : The stop time is truncated if the motor experiences severe torque fluctuations during the soft stop Off : The motor will stop in the set time.	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W
Address:53770 (D20A hex) Format: 8 bit unsigned Note: Binary value	**Shut Down (2)** This features controls the soft stop improve stability On : The stop time is truncated if the motor experiences severe torque fluctuations during the soft stop Off : The motor will stop in the set time.	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W
Address:53774 (D20E hex) Format: 8 bit unsigned Note: Binary value	**Thyristor Firing Trip** Detects if there is a fault with one or more of the internal Thyristors or bypass relays On : Trips if one or more of the Thyristors / bypass relays has failed short circuit. ISOLATE SUPPLY. Check by measuring the resistance between L1 -T1 L2 -T2 L3 -T3 (Anything < 10 ohms is assumed short circuit) Off : The Unit will attempt to start and run although the operation may be erratic. Operating in this mode for prolonged periods may result in SCR failure	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:53775 (D20F hex) Format: 8 bit unsigned Note: Binary value	**Current Sensor Trip** Detects if the internal current sensors have failed or reading a very low level. On : The Unit will trip if the internal current sensors fail or the current measured falls to a very low level Off : Will continue to operate even if the sensor has failed. Measurements and overload protection may be affected	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:53777 (D211 hex) Format: 8 bit unsigned Note: Binary value	**Motor Side Phase Loss** Detects if there is a disconnection between the Unit output and the motor On : Trips if there is a disconnection between the output side of the Unit and the motor Off : The Unit will attempt to start and run although the operation may be erratic. Operating in this mode for prolonged periods may result in SCR failure	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W
Address:53781 (D215 hex) Format: 8 bit unsigned Note: Binary value	**Sensing Fault Trip** Detects if there is a fault with operation of one or more of the internal Thyristors On : Trips if one or more of the Thyristors fails to turn on properly. Off : The Unit will attempt to start and run although the operation may be erratic. Operating in this mode for prolonged periods may result in SCR failure	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W
Address:53782 (D216 hex) Format: 8 bit unsigned Note: Binary value	**Fan Trip** Detects if the cooling fans have failed. On : The Unit trips if the cooling fans fitted to the Unit fail. Off : Will continue to operate and is likely to trip on a thermal trip as the heatsink will not be sufficiently cooled	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:53787 (D21B hex) Format: 8 bit unsigned Note: Binary value	**Low Current Trip** This can be used to detect if the motor is running lightly loaded. On : The Unit will trip. This feature is not active during soft start and soft stop. Off: The Unit will continue to operate regardless of motor current	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:53790 (D21E hex) Format: 8 bit unsigned Note: Binary value	**Start Current Limit Trip** Selects trip or continue if the current limit has been active for too long On : The Unit will trip Off: The start will continue regardless of the motor current level	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W
Address:53791 (D21F hex) Format: 8 bit unsigned Note: Binary value	**Stop Current Limit Trip** Selects trip or continue if the stop current limit has been active for too long On : The Unit will trip Off: The stop will continue regardless of the motor current level	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:53792 (D220 hex) Format: 8 bit unsigned Note: Binary value	**Overload Trip** The Unit has an "Overload" function that is an electronic equivalent to a thermal overload. On : The Unit will trip when the "Overload" capacity (ModbusPNU 33408) exceeds 100% Off: The Unit will continue to operate regardless of motor current level	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W
Address:53793 (D221 hex) Format: 8 bit unsigned Note: Binary value	**Shearpin Trip** The shearpin is an electronic equivalent of a mechanical shearpin On : The Unit will trip. This feature is not active during soft start and soft stop. Off: The Unit will continue to operate regardless of motor current level	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W

Address:53794 (D222 hex) Format: 8 bit unsigned Note: Binary value	**PTC Motor Thermistor Trip** A single PTC motor thermistor or set of PTC motor thermistors can be connected to the PTC terminals. On :The Unit will trip if the motor thermistor exceed its response temperature or the PTC input is open circuit Off : The Unit will continue to operate.	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:53795 (D223 hex) Format: 8 bit unsigned Note: Binary value	**External Trip** Allows a trip to be forced using one of the digital inputs On : Trips when the programmed input is active Off : External Trip is disabled	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) On		R/W
Address:53796 (D224 hex) Format: 8 bit unsigned Note: Binary value	**Communications Trip** Detects if the communications bus has failed or become inactive. To keep the bus active there must be at least one Modbus read or write (any PNU) during the "Timeout ms" period (ModbusPNU 15808) On :Communication trip enabled. Off : Communication trip disabled.	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W
Address:53798 (D226 hex) Format: 8 bit unsigned Note: Binary value	**Operation 1 Trip** Detects if the keypad Board has failed to operate normally On : Operation 1 trip enabled. Off : Operation 1 trip disabled.	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) Off		R/W
Address:53799 (D227 hex) Format: 8 bit unsigned Note: Binary value	**Operation 2 Trip** Detects if the logging function has failed to operate normally On : Operation 2 trip enabled. Off : Operation 2 trip disabled.	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) Off		R/W
Address:53800 (D228 hex) Format: 8 bit unsigned Note: Binary value	**Operation 3 Trip** Detects if the Control Board has failed to operate normally On : Operation 3 trip enabled. Off : Operation 3 trip disabled.	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W
Address:53803 (D22B hex) Format: 8 bit unsigned Note: Binary value	**Cover Open Trip** For safety purposes the Unit has been designed to trip if the front cover is open On : The Unit will trip if the front cover is open. This trip is active at all times. Off : The Unit will continue to operate with the cover open	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:53804 (D22C hex) Format: 8 bit unsigned Note: Binary value	**Remote Start Trip** For safety reasons the Unit will trip during some operations if the remote start signal is active On : Trips if the remote start signal is active when the Unit is powered up or a reset is applied. Off : The Unit will not trip and may start unexpectedly if the start signal is accidently left active.	0 (0 hex) Off 1 (1 hex) On 1 (1 hex) On		R/W

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:53807 (D22F hex) Format: 8 bit unsigned Note: Binary value	**L1-L3-L2 Trip** Determines if supply phase sequence is incorrect for motor rotation On : Trips if the phase sequence is L1-L3-L2. Off : The Unit will continue to operate normally	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:53808 (D230 hex) Format: 8 bit unsigned Note: Binary value	**L1-L2-L3 Trip** Determines if supply phase sequence is incorrect for motor rotation On : Trips if the phase sequence is L1-L2-L3. Off : The Unit will continue to operate normally	0 (0 hex) Off 1 (1 hex) On 0 (0 hex) Off		R/W
Address:59392 (E800 hex) Format: 16 bit unsigned Note: 0 = Local, 1 = User, 2 = TwoWire, 3 = ThreeWire, 4 = Modbus	**Control Method** Local Touch Screen : Control using the button on the keypad User Programmable : Control using the terminals. Function defined in "I/O" menu Two Wire Control : Control using terminals. Functions fixed as shown on screen Three Wire Control : Control using terminals. Functions fixed as shown on screen Modbus Network : Control via remote Modbus network or remote Keypad or Modbus TCP	0 (0 hex) Local Touch Screen 4 (4 hex) Modbus Network 0 (0 hex) Local Touch Screen		R/W
Address:60608 (ECC0 hex) Format: 16 bit unsigned Note: Linear Scaling (1 =1) See Trip Code Descriptions	**Last Trip** Displays the last Fault trip	0 (0 hex) 0 65535 (FFFF hex) 65535 0 (0 hex) 0		R
Address:60609 (ECC1 hex) Format: 16 bit unsigned Note: Linear Scaling (1 =1) See Trip Code Descriptions	**Last Trip -1** Displays the last Fault trip -1	0 (0 hex) 0 65535 (FFFF hex) 65535 0 (0 hex) 0		R
Address:60610 (ECC2 hex) Format: 16 bit unsigned Note: Linear Scaling (1 =1) See Trip Code Descriptions	**Last Trip -2** Displays the last Fault trip -2	0 (0 hex) 0 65535 (FFFF hex) 65535 0 (0 hex) 0		R
Address:60611 (ECC3 hex) Format: 16 bit unsigned Note: Linear Scaling (1 =1) See Trip Code Descriptions	**Last Trip -3** Displays the last Fault trip -3	0 (0 hex) 0 65535 (FFFF hex) 65535 0 (0 hex) 0		R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:60612 (ECC4 hex) Format: 16 bit unsigned Note: Linear Scaling (1 =1) See Trip Code Descriptions	**Last Trip -4** Displays the last Fault trip -4	0 (0 hex) 0 65535 (FFFF hex) 65535 0 (0 hex) 0		R
Address:60613 (ECC5 hex) Format: 16 bit unsigned Note: Linear Scaling (1 =1) See Trip Code Descriptions	**Last Trip -5** Displays the last Fault trip -5	0 (0 hex) 0 65535 (FFFF hex) 65535 0 (0 hex) 0		R
Address:60614 (ECC6 hex) Format: 16 bit unsigned Note: Linear Scaling (1 =1) See Trip Code Descriptions	**Last Trip -6** Displays the last Fault trip -6	0 (0 hex) 0 65535 (FFFF hex) 65535 0 (0 hex) 0		R
Address:60615 (ECC7 hex) Format: 16 bit unsigned Note: Linear Scaling (1 =1) See Trip Code Descriptions	**Last Trip -7** Displays the last Fault trip -7	0 (0 hex) 0 65535 (FFFF hex) 65535 0 (0 hex) 0		R
Address:60616 (ECC8 hex) Format: 16 bit unsigned Note: Linear Scaling (1 =1) See Trip Code Descriptions	**Last Trip -8** Displays the last Fault trip -8	0 (0 hex) 0 65535 (FFFF hex) 65535 0 (0 hex) 0		R
Address:60617 (ECC9 hex) Format: 16 bit unsigned Note: Linear Scaling (1 =1) See Trip Code Descriptions	**Last Trip -9** Displays the last Fault trip -9	0 (0 hex) 0 65535 (FFFF hex) 65535 0 (0 hex) 0		R
Address:60672 (ED00 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last Trip (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:60675 (ED03 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last Trip -1 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:60678 (ED06 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last Trip -2 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:60681 (ED09 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last Trip -3 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:60684 (ED0C hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last Trip -4 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:60687 (ED0F hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last Trip -5 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:60690 (ED12 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last Trip -6 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:60693 (ED15 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last Trip -7 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:60696 (ED18 hex) Format: 6 Bytes Note: Time(ms) since midnight (bytes5,4,3,2) and Days since 01/01/1984 (bytes1,0)	**Last Trip -8 (Time)** Displays the event time	- - GMT time	hh:mm:ss	R
Address:60699 (ED1B hex) Format: GMT time Note: hh:mm:ss	**Last Trip -9 (Time)** Displays the event time	- -		R
Address:62080 (F280 hex) Format: 16 bit unsigned Note: Binary value	**Reset Defaults** Restores the Unit to the factory defaults	0 (0 hex) No 1 (1 hex) Yes 0 (0 hex) No		R/W
Address:62144 (F2C0 hex) Format: 16 bit unsigned Note: Binary value	**Save Parameters** Saves all Read /Write parameters to non volatile memory Yes : Parameters are permanently written No : Parameters remain changed until next power cycle	0 (0 hex) No 1 (1 hex) Yes 0 (0 hex) No		R/W
Address:100101 (18705 hex) Format: Note: The Trip Number shown in PNU Name is a decimal value	**101** **Input Side Phase Loss** Phase L1 missing at the instant of start up. The L1 phase is either missing or at a very low level Check all incoming connections. If a main contactor is being controlled by a digital output set to "Running" check contactor delay is sufficient			R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:100102 (18706 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**102** **Input Side Phase Loss** Phase L2 missing at the instant of start up The L2 phase is either missing or at a very low level Check all incoming connections. If a main contactor is being controlled by a digital output set to "Running" check contactor delay is sufficient			R
Address:100103 (18707 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**103** **Input Side Phase Loss** Phase L3 missing at the instant of start up The L3 phase is either missing or at a very low level Check all incoming connections. If a main contactor is being controlled by a digital output set to "Running" check contactor delay is sufficient			R
Address:100104 (18708 hex) Format: Note: The Trip Number shown in PNU Name is a decimal value	**104 - 117** **Input Side Phase Loss** Any or all phases missing when the motor is being controlled L1 L2 or L3 phase are missing or at a very low level. Check all incoming connections. Check any fuses / breakers incorporated in the power circuit			R
Address:100201 (18769 hex) Format: Note: The Trip Number shown in PNU Name is a decimal value	**201** **Maximum Temp. Exceeded** Internal heatsink temperature has exceeded 90°C It is possible the Unit is operating outside specified limits. Check enclosure ventilation and airflow around the Unit. If the unit trips immediately the internal temperature sensor could be faulty.			R
Address:100208 (18770 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**208** **Thermal Sensor Trip** Thermal sensor Failure The internal temperature sensor has failed Contact the supplier			R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:100301 (187CD hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**301-308** **Thyristor Firing Trip** One or more of the internal control thyristors (SCRs) have failed to turn on properly. (In-Line "Firing Mode") The Unit has detected that the SCRs are not operating as expected. Check all incoming and outgoing connections.			R
Address:100351 (187FF hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**350-358** **Thyristor Firing Trip** One or more of the internal control thyristors (SCRs) have failed to turn on properly. (Delta "Firing Mode") The Unit has detected that the SCRs are not operating as expected. Check all incoming and outgoing connections.			R
Address:100401 (18831 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**401** **Motor Side Phase Loss** One or all of the phases are missing on the motor side during the instant of start up T1 T2 or T3 phase are missing or at a very low level. Check that the motor is connected to T1 T2 and T3. Ensure any disconnecting device between the Unit and the motor is closed at the instant of start up.			R
Address:100402 (18832 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**402-403** **Motor Side Phase Loss** One or all of the phases are missing on the motor side during the instant of start up when the motor being controlled T1 T2 or T3 phase are missing or at a very low level. Check all incoming and outgoing connections.			R
Address:100601 (188F9 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**601** **Control Voltage Too Low** The internal control supply of the Unit level has fallen to a low level Can be caused by a weak 24VDC control supply. Ensure 24VDC supply meets the requirements specified in the Quick Start Guide.			R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:100701 (1895D hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**701-710** **Sensing Fault Trip** One or more of the internal control thyristors (SCRs) have failed to turn on properly. The Unit has detected that the SCRs are not operating as expected. Check connections all incoming and outgoing connections.			R
Address:100801 (189C1 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**801-802** **Fan Problem** One or more of the internal cooling fans has failed To ensure the heatsink is cooled sufficiently the Unit Will trip if the fans fail to operate Check Unit fans for signs of damage or contamination			R
Address:101001 (18A89 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**1001** **Short Circuit Thyristor** One or more of the internal control thyristors (SCRs) have failed short circuit The Unit has detected that the SCRs are not operating as expected. ISOLATE SUPPLY. Check by measuring the resistance between L1-T1 L2-T2 L3-T3 (Anything < 10R is assumed short circuit)			R
Address:101101 (18AED hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**1101** **Low Current Trip** The motor current has been lower than the low trip level for the low trip time This trip is not active during soft start and soft stop and is "off" by default. If the low current trip is not required turn "off" in "Trip Settings".			R
Address:101201 (18B51 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**1201** **Current Limit Timeout Trip** The motor has been held in current limit longer than the "Start current limit Time" It is likely that the current limit level has been set too low for the application. Increase the current limit level or timeout period.			R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:101202 (18B52 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**1202** **Current Limit Timeout Trip** The motor has been held in current limit longer than the "Stop current limit Time" It is likely that the current limit level has been set too low for the application. Increase the current limit level or timeout period.			R
Address:101301 (18BB5 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**1301** **Overload Trip** The "Overload" has exceeded 100% The Unit is attempting to start an application that is outside its capacity or it is starting too often. Refer to the overload trip curves to determine whether the Unit has been sized correctly.			R
Address:101302 (18BB6 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**1302** **Overload Trip** The motor current has exceeded 475% (i-Unit) for a time greater than 250ms The Unit is attempting to start an application that is outside its capacity with a "high current limit level" set Refer to the overload trip curves to determine whether the Unit has been sized correctly and check current limit level.			R
Address:101401 (18C19 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**1401** **Shearpin Trip** The motor current has been higher than the "Shearpin Trip Level" for the trip time. This trip is not active during soft start and soft stop and is "off" by default. If Shearpin trip is not required turn "off" in "Trip Settings".			R
Address:101501 (18C7D hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**1501** **PTC Thermistor Trip** The PTC thermistor value has exceed the trip level. The PTC thermistor connected to the PTC input has exceeded it response temperature or the PTC input is open circuit. If the PTC TRIP is not required turn "off" in "Trip Settings".			R

5. Modbus RTU Parameter Table (continued)

Address	Description	Min/Max/Default	Units	Read/ Write
Address:101701 (18D45 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**1701** **Communications Trip** Communications failure The command or status PNU has not been polled in the time set in the "Timeout" period If the communication trip is disabled the Unit cannot be stopped in the communications fail			R
Address:101801 (18DA9 hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**1801-1802** **Bypass Relay Trip** One or more of the internal bypass relays has failed to close The internal bypass relay has failed or the control supply is to weak. Ensure 24VDC supply meets the requirements specified in the Quick Start Guide.			R
Address:101802 (18DAA hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**1803** **Bypass Relay Trip** One or more of the internal bypass relays has failed to open The internal bypass relay has failed or the control supply is too weak. Ensure 24VDC supply meets the requirements specified in the Quick Start Guide.			R
Address:101901 (18E0D hex Format: Note: The Trip Number shown in PNU Name is a decimal value	**1901** **Cover Open, Close to Enable** Motor Start The Unit cover is open The cover is open or not closed properly Close Cover or if Cover trip is not required turn off in "Trip Settings"			R

6.Trip and Fault Codes

Chapter 6

6.1Trip Code Descriptions

Trip Codes (from Trip Log)	
Number & Name	**Description**
101 Input Side Phase Loss	Phase L1 missing at the instant of start up. • The L1 phase is either missing or at a very low level. • Check all incoming connections. • If a main contactor is being controlled by a digital output set to "Running," check that "Contactor Delay" (under "Start Settings") is sufficient.
102 Input Side Phase Loss	Phase L2 missing at the instant of start up. • The L2 phase is either missing or at a very low level. • Check all incoming connections. • If a main contactor is being controlled by a digital output set to "Running," check that "Contactor Delay" (under "Start Settings") is sufficient.
103 Input Side Phase Loss	Phase L3 missing at the instant of start up. • The L3 phase is either missing or at a very low level. • Check all incoming connections. • If a main contactor is being controlled by a digital output set to "Running," check that "Contactor Delay" (under "Start Settings") is sufficient.
104 - 117 Input Side Phase Loss	Any or all phases missing when the motor is being controlled (running). • L1, L2, or L3 are missing or at a very low level. • Check all incoming connections. • Check any fuses/breakers incorporated in the power circuit.
201 Maximum Temperature Exceeded	Internal heatsink temperature has exceeded 80°C. • It is possible the STS is operating outside specified limits. • Check enclosure ventilation and airflow around the STS • If the unit trips immediately, the internal temperature sensor could be faulty.
208 Thermal Sensor Trip	Thermal sensor failure. • The internal temperature sensor has failed. • Contact your supplier
300-307 Thyristor Firing Trip	One or more of the internal control thyristors (SCRs) have failed to turn on properly (In-Line "Firing Mode") • The STS has detected that the SCRs are not operating as expected. • Check all incoming and outgoing connections.
350-357 Thyristor Firing Trip	One or more of the internal control thyristors (SCRs) have failed to turn on properly (Delta "Firing Mode"). • The STS has detected that the SCRs are not operating as expected. • Check all incoming and outgoing connections.

6. Trip and Fault Codes (continued)

Trip Codes (from Trip Log)	
Number & Name	**Description**
401 Motor Side Phase Loss	One or all of the phases are missing on the motor side during the instant of start up • T1, T2, or T3 are missing or at a very low level. • Check that the motor is connected to T1, T2 and T3. • Ensure any disconnecting device between the STS and the motor is closed at the instant of start up.
402-403 Motor Side Phase Loss	One or all of the phases are missing on the motor side during the instant of start up when the motor is being controlled. • T1, T2 or T3 are missing or at a very low level. • Check all incoming and outgoing connections.
601 Control Voltage Too Low	The internal control supply of the STS level has fallen to a low level. • Can be caused by a weak 24VDC/115VAC/230VAC control supply. • Ensure 24VDC/115VAC/230VAC supply meets the requirements specified in "Electrical Installation" Chapter 2 or the Quick Start Guide.
701-710 Sensing Fault Trip	One or more of the internal control thyristors (SCRs) have failed to turn on properly. • The STS has detected that the SCRs are not operating as expected. • Check connections all incoming and outgoing connections.
801-802 Fan Problem	One or more of the internal cooling fans has failed. • To ensure the heatsink is cooled sufficiently, the STS will trip if the fans fail to operate. • Check STS fans for signs of damage or contamination.
1001 Short Circuit Thyristor	One or more of the internal control thyristors (SCRs) have failed short circuit. • The STS has detected that the SCRs are not operating as expected. • Check all incoming and outgoing connections.
1201 Current Limit Timeout Trip	The motor has been held in current limit longer than the "Start Current Limit Time." • It is likely that the current limit level has been set too low for the application. • Increase the current limit level or timeout period.
1202 Current Limit Timeout Trip	The motor has been held in current limit longer than the "Stop Current Limit Time." • It is likely that the current limit level has been set too low for the application. • Increase the current limit level or timeout period.
1301 Overload Trip	The "Overload" has exceeded 100%. • The STS is attempting to start an application that is outside its capacity or it is starting too often. • Refer to the overload trip curves to determine whether the STS has been sized correctly.
1302 Overload Trip	The motor current has exceeded 475% (i-STS) for a time greater than 250ms. • The STS is attempting to start an application that is outside its capacity with a "high current limit level" set. • Refer to the overload trip curves to determine whether the STS has been sized correctly, and check current limit level.

6. Trip and Fault Codes (continued)

Trip Codes (from Trip Log)	
Number & Name	**Description**
1401 Shearpin Trip	The motor current has been higher than the "Shearpin Trip Level" for the "Shearpin Trip Time." • This trip is not active during soft start and soft stop, and is "off" by default. • If "Shearpin Trip" is not required, turn "off" in "Trip Settings."
1501 PTC Thermistor Trip	The PTC thermistor value has exceed the trip level (4kΩ). • The PTC thermistor connected to the PTC input has exceeded its response temperature, or the PTC input is open circuit. • If the PTC Trip is not required, turn "off" in "Trip Settings."
1701 Communications Trip	Communications failure. • A parameter has not been written to or polled in the time set in the "Timeout" period (under "Device Networks"). • If the "Communications Trip" is disabled, the STS will not be stopped by the communications failure.
1801-1802 Bypass Relay Trip	One or more of the internal bypass relays has failed to close. • The internal bypass relay has failed or the control supply is to weak. • Ensure 24VDC supply meets the requirements specified in "Electrical Installation" Chapter 2 or the Quick Start Guide.
1803 Bypass Relay Trip	One or more of the internal bypass relays has failed to open. • The internal bypass relay has failed or the control supply is too weak. • Ensure 24VDC supply meets the requirements specified in "Electrical Installation" Chapter 2 or the Quick Start Guide.
1901 Cover Open, Close to Enable Motor Start	The STS cover is open. • The cover is open or not closed properly. • Close cover, or if Cover Trip is not required, turn off in "Trip Settings."
2001 Remote Start is Enabled	The Remote Start signal is active. • The "Start/Stop" signal was active during power up or Reset. • Turn off "Start/Stop," or if Remote Start trip is not required, turn "off" in "Trip Settings."
2101 Rotation L1 L2 L3 Trip	The input phase rotation is RYB (L1, L2,L3). • The phase rotation is opposite to that required. • Change phase rotation, or if "RYB" trip is not required, turn "off" in "Trip Settings."
2102 Rotation L1 L3 L2 Trip	The input phase rotation is RBY (L1, L3,L2). • The phase rotation is opposite to that required. • Change phase rotation, or if "RBY" trip is not required turn "off" in "Trip Settings."
2013 Rotation Undetermined Trip	The phase rotation is undetermined. • The STS is unable to determine whether the input phase rotation is L1, L2, L3 or L1, L3, L2. • Check all incoming and outgoing connections.
2201-2209 MPU Trip	Internal STS Failure of the main processing unit. • The STS has failed internally and is unable to recover automatically. • Cycle the control supply. • If the fault is not cleared, contact your supplier

6. Trip and Fault Codes (continued)

6.2 Fail Safe Codes

6.2.1 Main Board Trip (2402 – 2436)

A trip number in the range of 2402 to 2436 indicates that a process on the main board has been affected in some way and is unable to recover automatically.

- The trip is turned ON and OFF via the "Main Board Trip" (Advanced / Trips).
- The default for this trip is ON.
- The trip MUST be reset using the either the digital input, touchscreen, or bus command depending on the control method set.
- As this is a special case, it is NOT possible to reset this trip by cycling the control supply.

Fail Safe Codes Associated with the Main Board	
Code	**Description**
2402	Initialization process has been unsuccessful.
2404	Initialization of the Parameters has been unsuccessful.
2406	Initialization of the Overload has been unsuccessful.
2408	Initialization of the Parameter Read has been unsuccessful.
2410	Initialization of the Overload Read has been unsuccessful.
2412	Initialization of the Current measurement has been unsuccessful.
2420	A main process on the Main Board has been affected and is unable to recover automatically.
2422	A main process on the Main Board has been affected and is unable to recover automatically.
2424	A main process on the Main Board has been affected and is unable to recover automatically.
2426	Communication between the Main Board and Touchscreen Board has been affected and is unable to recover automatically.
2428	The modbus communication has been affected and is unable to recover automatically.
2430	The parameter save has been unsuccessful.
2432	The logging function has been unsuccessful.
2434	A main process on the Main Board has been affected and is unable to recover automatically.
2436	The Anybus communication has been affected and is unable to recover automatically.

6.2.2 Touchscreen Trip (2501 – 2581)

A trip number in the range of 2501 to 2581 indicates that a process on the touchscreen board has been affected in some way and is unable to recover automatically.

- The trip is turned ON and OFF via the "Touchscreen Trip" (Advanced / Trips).
- The default for this trip is OFF.
- With the trip OFF the touchscreen display may display the 'start up' screen momentarily as it recovers automatically.
- When the trip is turned ON it is reset using the either the digital input or touchscreen or bus command, depending on the control method set.
- It is possible to reset this trip by cycling the control supply.

Fail Safe Codes Associated with the Touchscreen Board		
Local Touchscreen	**Remote Touchscreen**	**Description**
2501 – 2529	2551 – 2579	A main process on the Touchscreen Board has been
2530	2580	Communication between the Main board and Touchscreen Board has been affected.
2531	2581	The touchscreen has become unresponsive.

When a remote touchscreen is used, the same trips can be generated. To discriminate between the remote and local screen 50 is added to each code.

6. Trip and Fault Codes (continued)

6.2.3 Logging Trip (2601 – 2603)

Trip numbers that are in the range of 2601 to 2603 indicate that a process associated with the logging has been affected in some way and has been unable to recover automatically.

- The trip is turned ON and OFF via the “Logging Trip” (Advanced / Trips).
- The default for this trip is OFF.
- With the trip OFF, the logging function will temporarily be disabled if a continual failure is detected.
- When the trip is turned ON, it is reset using the either the digital input or keypad or bus command, depending on the control method set.
- It is possible to reset this trip by cycling the control supply.

Fail Safe Codes Associated with the Logging Function	
Code	**Description**
2601	The initialization of the event logging function has been unsuccessful for 20 consecutive attempts.
2602	The event logging function has been unsuccessful for 20 consecutive attempts.
2603	The SD card could not be accessed after 20 consecutive attempts.

Chapter 7

7. Intelligent Energy Recovery (iERS)

7.1 Principles

Every wound-field electric motor must consume some minimum amount of energy to provide a magnetic field which enables it to work at all. With DC motors the field is under separate control, so that the amount of magnetising energy can be adjusted to be sufficient to overcome losses and provide an armature reaction appropriate to the load.

The squirrel cage AC induction motor has no such provision, with the result that at any load less than it's rated full load (at full speed), energy is wasted. When a squirrel-cage motor is supplied at a constant terminal voltage, as when it is connected directly to the supply without a controller of any kind, the strength of the field flux is fixed by the supply voltage. At normal running speed the field will take a fixed quantity of energy regardless of the torque demanded by the mechanical load.

The energy required to support the load torque is determined by the torque demand. As load torque increases, the rotor slows down a little (i.e. 'slip' increases), causing the induced rotor currents to increase also, and so to increase the torque. These additional currents in the rotor are balanced by additional current in the stator coils.

Conversely, if load torque demand falls, the slip decreases, the rotor currents decrease, and the current in the stator decreases accordingly. But at constant terminal voltage, the current, and therefore the energy, providing the stator field flux remains unchanged at any level of load torque demand. As a consequence, the efficiency of an induction motor falls as the load falls.

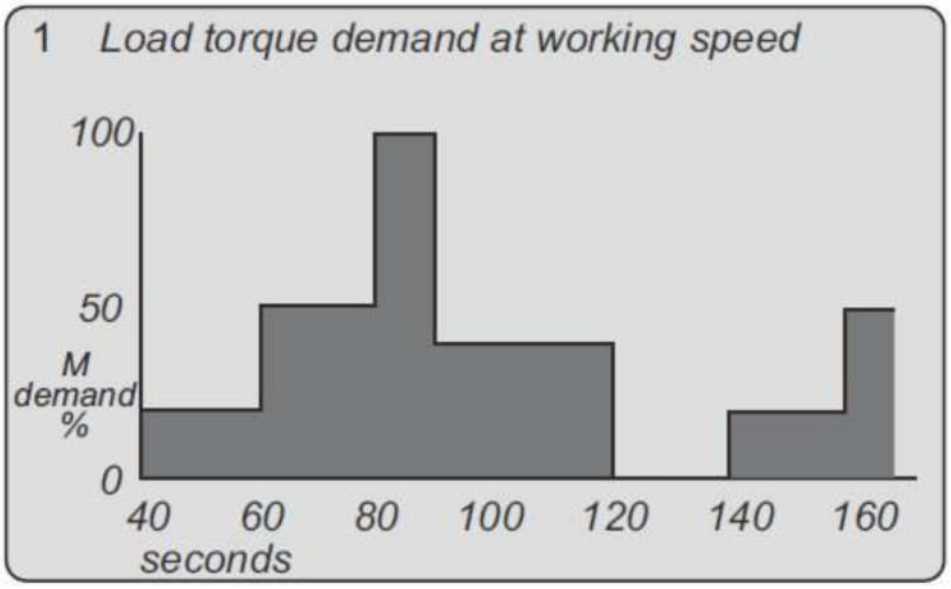

Figure7.1.1: Typical duty cycle for a machine load where the Torque Demand varies.

7. Intelligent Energy Recovery (continued)

7.1 Principles (continued)

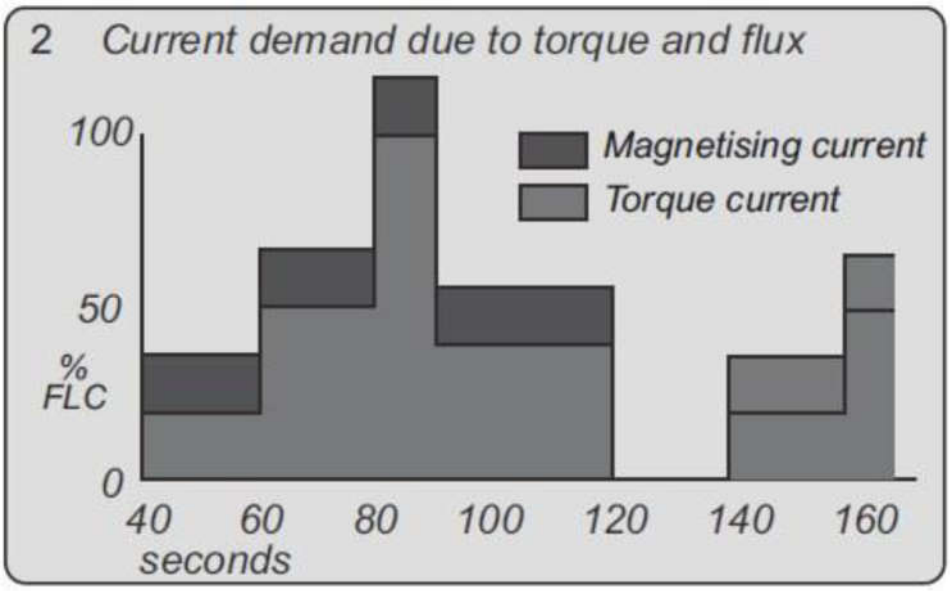

Figure 7.1.2 Torque Demand converted to an equivalent current with the motor magnetizing current added

7.2 Advantages of IERS

A soft starter with an iERS feature alters the motor operation. The iERS function reduces the terminal voltage applied to the motor so that the energy needed to supply the field is more-closely proportioned to the torque demand. The effect is shown in the Figure below.

NOTE the curves shown in Fig. 3 are the 'full speed' end of the conventional torque/current curves. The present considerations do not affect soft starting options or strategies. When the motor terminal voltage is at its 'nominal' or rated value and when the load is the maximum for which the motor is rated, the operating point of the motor on the current curve is at A.

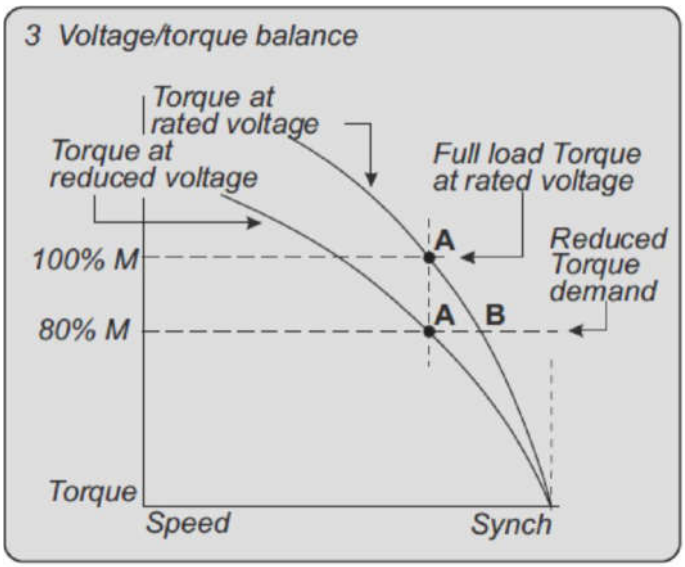

Figure 7.2.1

7. Intelligent Energy Recovery (continued)

7.2 Advantages of iERS (continued)

If the load falls, a motor supplied at a fixed voltage will speed up slightly, the current demand will reduce, and the operating point moves along the curve to point B. Because the torque developed by a motor is proportional to the square of the applied voltage, lowering the terminal voltage reduces the torque. If the reduced voltage is correctly chosen, the working point at the reduced torque demand becomes the point A'.

By reducing the terminal voltage, the motor has in effect been 'changed' for one which has a lower rated power output. A reduced terminal voltage also means a reduced field energy requirement and this simple relationship enables the iERS function to maintain the efficiency of the motor over nearly the whole of the load range from 'no load' upwards.

In practical terms, 'no load' means no external load. There are the internal mechanical and electrical losses to be overcome - friction and windage of the rotor at speed, and the electrical heating and hysteresis losses. The ideal response to the 'no load' condition would be to supply precisely the amount of magnetising current needed to provide the armature reaction to balance the losses. This is what the iERS feature of a soft starter seeks to do, continuously and automatically.

7.3 Additional Benefits in Practice

It is usual to select a standard motor with a rating somewhat higher than the maximum demand of the driven load. The motor selected for any given application will almost certainly be over-rated for this reason alone and therefore, when supplied at rated voltage, energy could be saved even at full load.
Furthermore, there are those applications where the size of motor has to be chosen to provide for high loadings which occur only intermittently, although the load demand at other times is much less.

7.4 How Much Energy?

The amount of energy used by a squirrel cage induction motor operating with a soft starter in iERS mode is shown in Fig. 7.4.1, for the same duty cycle as Fig. 7.1.1. By reducing the voltage when torque demand is below maximum, the magnetising current is proportioned to the torque current.
Compare Fig. 4, energy-optimising, with Fig. 7.1.2, non - iERS.
(These graphical representations are illustrative only, not to scale.) To arrive at any exact figure for the energy saved requires each individual case to be examined in detail, taking into account the following variables;

- Motor rating, type, and any special characteristics;
- Load, load characteristics, duty cycle;
- Supply voltage; Supply authority tariffs and the user's particular terms.

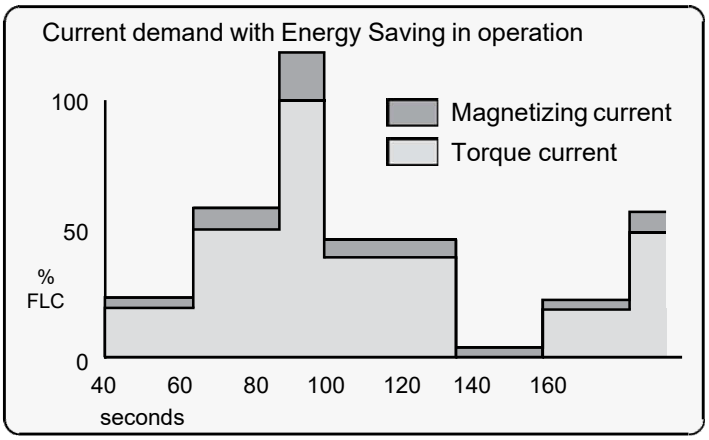

Figure 7.4.1: Energy Savings

7. Intelligent Energy Recovery (continued)

7.4 How Much Energy (continued)

The calculations to cover all the likely or possible conditions would be laborious. An empirical method for arriving at a usefully realistic estimate has been devised by Fairford Electronics Ltd.

Used with a proper sense of engineering circumspection, the tables on page 10 allow a user to gain a reasonably close estimate of the saving to be achieved within the motor by using an iERS soft starter. The method does not include any additional savings and benefits conferred by other sources, such as -

- Reduction of heating losses in cabling because of the lower voltages
- Further energy saving and other benefits deriving from the soft starting process itself
- Reduced total energy demand,
- Reduced wear and tear
- Reduced maintenance and replacement costs

7.5 Estimating Energy Savings

7.5.1 Basis for estimation

- 3-phase squirrel cage induction motor, standard type.
- Supply: 380 to 440V, 50Hz.
- Supply voltage >min. working voltage on motor rating plate.
- Operation 30% rated nameplate full load.

Table 7.5.1 - Energy Savings Estimations

Motor Size	*kW*	*HP*	*Estimated Savings (% rated kW)*
Less than	5	7.5	10
	22.5	30	6.5
	55	75	3.5
	110	150	2.5
More than	110	150	1.5

Table 7.5.2 - Energy Savings Modifying Factors

Motor Poles		*Motor Slip*	
Number of	*Add (% kW)*	*% Slip*	*Add (% kW)*
2	-0.5	0.5	-0.5
4	0	2	0
6	0.5	3.3	0.5
8	1	5	1

7. Intelligent Energy Recovery (continued)

7.6 Examples of Estimated Saving

1) A 37.5 kW 4-pole motor
From Table 7.5.1, use the estimated saving figure for the next higher rating, ie 55 kW.
The saving would be, approximately - 3.5% x 37.5 kW = 1.3125 kW

2) A 37.5 kW2-pole motor.
From Table 7.5.1, use the estimated saving figure for the next higher rating, ie 55 kW.
From Table 7.5.2, apply the pole-number factor of -0.5 %. The saving would be, approximately - (3.5 % - 0.5 %) x 37.5 kW = 1.125 kW

3) A 37.5 kW Z-pole 'low slip' motor.
From Table 7.5.1, use the estimated saving figure for the next higher rating, ie 55 kW.
From Table 7.5.2, apply the pole-number factor of -0.5 % and the %-slip factor of0.5%.
The saving would be, approximately - (3.5 % - 0.5 % - 0.5 %) x 37.5 kW = 0.938 kW

7.7 iERS with STS™

During start-up, the STS™ software uses a patented method to compute and store a reference value for the power factor. When the motor has reached full speed and is driving the load at the demanded torque, STS™ enters the 'motor running' stage. At this stage, if required, the motor may also operate in 'iERS Mode'. Entering this mode can be pre-set from the STS™ touchscreen and stored for automatic operation, which will suit the majority of applications where it is required. This is the default operating mode for STS™. It can also be toggled on and off while running by using either the iERS button in the Advanced Settings of the touchscreen, or through external circuitry connected to one of the programmable inputs and controlled by the driven process.

'iERS' Intelligent Energy Recovery System will sense when at a level where we will gain no benefits from Energy Saving, STS™ will energize the bypass relays, and there will be minimal losses from the motor controller.

Energy Saving will try to be active at all times and is fully automatic. The bypass relays will only energize depending upon the measured thermal capabilities of the unit, percentage loading of the motor, and the power factor, etc.

The bypass relays will open at 80% loading of the motor current set and enter the energy saving mode. The relays will not re-energize until the unit measures a level of at least 90% of the motor current set, or we have surpassed the measured thermal capabilities of the unit, or the power factor is close to full loading.

There should be even higher levels of energy saving, as when the motor is fully loaded the relays will be energized and we will have no losses in the thyristors. We will therefore gain maximum saving which is especially beneficial on typical cyclic loading applications such as pump jacks, injection molding machines, mixers, saws, etc.

In iERS mode the reference power factor is continuously compared with the running power factor. The software continuously uses this comparison to compute and adjust the firing point of the thyristors in order to maintain the best power factor. This method of continuous control minimizes wasted energy caused by overfluxing the motor. It also maintains the power factor at the most appropriate value for every condition of load demand. This can produce a significant reduction in the kVA demand.

7. Intelligent Energy Recovery (continued)

7.7 iERS with STS™ (continued)

This is an operating condition that may, at light or partial load conditions, provide the benefit of energy saving and if selected, is continuous from the dwell period until a STOP command is initiated or the mode is disabled. It should be noted that this function is inhibited by the software if the current being drawn by the motor exceeds 80% of the set current of STS™ (at full voltage when the motor enters its running stage with the iERS mode selected).

The method of power factor management described does not affect motor performance, nor does it detract from the motor's capability to respond to changes in load demand. This feature of the STS™ Soft Starter is a purely electrical function which has the effect of ensuring that the motor delivers the torque demanded at all times, but allows it to draw only the precise amount of magnetizing current required to support that torque output. Without this feature, the motor would draw the maximum magnetizing current regardless of load. The iERS function cannot improve the power factor beyond what it would ordinarily be at full load, but it does make the optimum improvement possible at any partial load.

iERS
Intelligent Energy Recovery System

Chapter 8

8. Applications

8.1 Motor Suitability and Associated Considerations

The STS™ soft-starter is based on the "Fairford System" of microprocessor-based optimising soft-starters which have been used world-wide in critical and non-critical systems. Since 1983, Fairford System soft-starters have successfully operated with almost every type of load and environment from the Antarctic to the Jungle. The design has proven to be both reliable and adaptable, and provides a powerful mechanism with which to control fixed-speed induction motors. However, due to the intrinsic differences between electronic and electro-mechanical starting systems, there are a number of simple rules and observations to follow when using the STS™ soft-starter. This section introduces guidelines for the user and those incorporating the unit as part of their system design.

8.1.1 Suitability

In principle, any induction motor can be started by a soft-starter. Normally, the breakaway torque of the load should be less than the full-load torque of the motor, unless a motor with a high locked rotor torque characteristic is employed. As a quick assessment, any load which has a low or no-load start with a moderate starting time, or which can be started with a star-delta starter, auto transformer or other forms of reduced-voltage starting, can be considered to be a potential application for a soft-starter

8.1.2 Induction Motor Characteristics

Induction motors are required to provide sufficient torque to accelerate the motor and its load from standstill to full speed and to maintain full speed efficiently at all torque levels up to the design full load torque. Most modern induction motors have characteristics that are wholly suitable for use with soft starters, however, the characteristics vary considerably between different manufacturers and design types. It is important that the motor is capable of providing sufficient torque to drive the load at all speeds between standstill and rated speed, to enable the STS™ to function properly. It is particularly important that the motor to be soft started does not have a low pull-up or saddle torque otherwise the load may not be accelerated correctly.

The primary function of the soft-starter is to act as a torque-regulating device. It cannot apply a torque greater than that which the motor generates. For this reason, problematic applications for which many different starting methods have been tried but failed, may need analysis of the motor or load performance before a soft-start can be successfully applied.

8.1.3 Rating

For most applications, except high inertia loads, the starting demands and the inertia of the rotating masses are small enough to be insignificant. This means that no special consideration needs to be given to the rating of the soft-starter, other than to ensure that it is equal or marginally greater than the rated voltage and current of the controlled motor.

Alternatively, if the number of poles of the motor and the moments of inertia of the load (Jload) and motor rotor (Jmotor) are known, a soft-starter will be suitable if the figures comply with the criteria given in the bottom row of following table

Table 8.4.1

Number of Poles	2	4	6	8
Synchronous Speed (rpm)	3000	1500	1000	750
(Jload)/(Jmotor) less than	5	15	20	25

8. Applications (continued)

8.1.4 Maximum Motor Cable Length
The length of the cable between the output terminals of the starter and the motor should not normally be greater than 100 metres.

8.1.5 Power Factor Correction Capacitors
Power factor correction capacitors applied to a single motor MUST always be connected by a separate contactor placed on the SUPPLY side of the STS™ soft-start. Capacitors should be switched in after top-of-ramp (full line voltage) is reached and switched out of circuit before a stop is initiated.
It is important that any total system PFC scheme that automatically corrects for a range of inductive loads is not operated in such a way as to leave it heavily over compensated since this might introduce oscillations leading to damaging over-voltages.

8.1.6 Lightly Loaded, Small Motors
Lightly loaded, small-sized (less than 2kW), star connected motors can produce high voltages at the motor terminals when shut down by simply opening the line contactor. As these voltages can damage the soft-starter, it is safer to control the opening of the line contactor with the soft start run relay contacts.

8.1.7 Motors Fitted with Integral Brakes
Motors that include an integral, electrically operated brake, internally connected to the motor input terminals, can only be soft-started when the brake is re-connected to the supply through its own contactor.

8.1.8 Older Motors
The action of the fully-controlled soft-starter introduces harmonic currents and voltages to the motor. It is therefore, important to ensure that the motor employs techniques such as rotor skewing in its construction to suppress the effects of harmonic fluxes and avoid rough starting. This is rarely a problem with modern motors because nearly all motors designed in the last 20 years employ these techniques.

8.1.9 Wound-rotor or Slip-ring Motors
Slip-ring induction motors ALWAYS need some resistance in the rotor circuit to ensure that sufficient rotational torque is generated to overcome any alignment torque, which is present at start-up. The resistance can be safely shorted out in the normal fashion with a contactor controlled by the programmable relay set as ‘top-of-ramp’ contacts.

8.1.10 Enclosures
Thyristors are not perfect conductors, and the passage of current through them causes heat dissipation in the body of the device, which in turn causes the heatsink temperature to increase. As a rough guide, the heat generated is 1 watt/amp/phase when energy saving, which equates to a dissipation of 30 watts from the heatsink for a line current of 10 amps. Therefore, all cabinets or enclosures that house soft-starters should have adequate ventilation. (Refer to the Mechanical installation procedures, section 1.0 for more detailed information.)

8.1.11 High-Efficiency Motors
Due to an inherently steep front to the speed/torque curve, high efficiency motors can exhibit instability when lightly loaded and the iERS parameter group may need adjusting to compensate.

8.1.12 EU Compliance with the EMC Directive
When considering the use or fitting of any Soft Starter, users and installers in European countries must comply with the EMC Directive 89/336/EEC. The manufacturer of the soft starter

8. Applications (continued)

has a statutory obligation to provide a guide for compliance with this directive. For STS, this guidance is given in the EMC guide which is section 9 of this manual. It is essential that users and installers understand and comply with the requirements described in these sections.

8.1.13 Fuses

Circuit protection fuses should be rated at twice the motor rated current for normal low inertia applications. See also section 8.2.2 relating to high inertia loads. Semiconductor fuses are available for the short circuit protection of the thyristors in STS. See section 2.5 of the Electrical Installation manual for Semiconductor fuse recommendations and details of the Overload incorporated into STS.

8.2 Rules for Specific Applications

8.2.1 In-Delta Operation

The STS™ control system allows the soft-start to be installed "in the delta" connections of the motor, which can permit the use of a lower current rated unit. However, in this mode of operation, it is important that the soft start is connected in accordance with the relevant wiring diagram. The connection diagram in Section 2.9 of the Electrical Installation manual gives detailed instruction for this configuration. If motor rotation is incorrect, the connections should be changed as detailed in Section 2.9. It should be noted that six connections are required between the motor and soft-start. The Firing Mode parameter (Advanced Menu) must be set to delta mode which also disables the optimising.

8.2.2 High Inertia Loads

High inertia loads such as centrifugal and axial fans, grinders, flywheel presses, etc., may require a larger size of soft-start than the motor. For example, a 75kW starter may be needed for a 55kW motor. This is necessary due to the extra heat produced by the thyristors due to the extended start times and/or higher over-currents. If very high inertia loads are involved, then an analysis of the starting characteristics should be made. This will require accurate data about the motor speed-torque and speed-current characteristics as well as the load characteristics. For further information, consult your supplier. Consideration must also be given to thermal overload and fuse protection systems when extended start times are involved. This must be as for heavy duty starting, as a standard thermal overload will trip under these conditions. A heavy-duty start thermal overload or an electronic overload with dual settings for start and run is recommended. Modern HRC motor fuses will allow for some overload during the start, but the fuse curve, giving time/current data, will give an indication of suitability for the particular application.

8.2.3 Frequent Starting

High starting frequencies require careful consideration of the soft-start thermal capabilities. In many cases a standard sized STS may be suitable as start times are generally shorter for this type of application. If this is not the case then a larger soft-start may be required. (Please refer to SIT Automation for further information.)

8.2.4 iERS

Drives which operate for long periods of time at less than 35% of their rated capacity can benefit from the energy saving function (iERS optimising) of STS which will adjust the thyristor triggering to reduce the excitation losses of the motor. This will lower the running temperature of the machine and help to extend it's life.

8.2.5 Soft-Stopping

Soft-stopping can reduce positive surge pressures in pipelines on shutdown. It is necessary to make sure that the ramp-down time is long enough to remove the energy from the fluid before the firing of the thyristors is stopped, otherwise the surge pressure may still be present. Soft-stopping can also be successfully applied to loads such as conveyer belt systems where sensitive items such as bottles are being transported.

8. Applications (continued)

8.2.6 Reversing Configuration

STS soft-starters used in conjunction with contactor controlled reversing and plug-braked motors show considerable benefits to the user by reducing mechanical and electrical stresses, particularly when utilising the current limited start feature. It is required, with this type of application, to insert a 150 to 350 millisecond delay between the opening of one contactor and the closing of the other, to allow any residual flux in the rotor to die away. See section 2.9.3 for details.

8.2.7 Replacement of Fluid Couplings

Soft-starters can replace fluid couplings yielding benefits of higher efficiency running and lower costs to the user. If the coupling is used to magnify the available breakaway torque, it may be necessary to replace the fitted motor with another of a larger size or one with a high starting torque characteristic before a soft-start can be employed.

8.2.8 Two-speed Motor Applications

Two speed motors, whether Dahlander connected or with dual windings, can be soft started at each speed, provided that the start is initiated when the actual motor speed is less than the synchronous speed for the winding selected. This is particularly important when changing from high to low speeds.

8.2.9 Multiple Motor Starting

See section 2.9.4 of the Electrical Installation chapter for details.

8.2.10 Overhauling Loads

Certain applications can over-speed the motor as part of normal operation. Power flow is then from the motor to the supply. It is important that the optimising is disabled during the over-speed condition and reinserted during normal conditions.

8. Applications (continued)

8.2.11 Application Table

The table on the following page shows many common motor applications that suit the STS soft-starter. It lists typical breakaway torque requirements as a percentage of motor full-load torque (FLT). For the most satisfactory soft-start in a given application, the motor should have a full-voltage locked-rotor-torque (LRT) that is at least twice the breakaway torque. (E.g. For a reciprocating compressor the FLT is normally in the region of 50% motor LRT.) As a general rule, the higher the motor LRT is above the load breakaway torque, the greater the control over the starting process.

Table 8.2.1– Applications

Application	Breakaway Torque (%FLT)	Remarks
Agitator	35	–
Air compressor- rotary, unloaded start	25–35	–
Air compressor- reciprocating, unloaded	50–100	–
Air compressor- screw type, unloaded	30	Usually two-pole motor
Ball mill	30–50	Eccentric load, needs high starting torque
Carding machine	100	Often high inertia
Centrifuge	50–90	Usually high inertia
Centrifugal fan- dampers closed	10–25	Usually high inertia
Centrifugal fan- dampers open	10–25	Usually high inertia, very long ramp times
Centrifugal blower- valve closed	25–35	–
Centrifugal blower- valve open	30–40	Can have long ramp time
Conveyor- horizontal, unloaded	10–50	–
Conveyor- horizontal, loaded	100–150	–
Conveyor- vertical lifting, unloaded	50–85	–
Conveyor- vertical lifting, loaded	100–175	–
Conveyor- vertical lowering, unloaded	10–40	–
Conveyor- vertical lowering, loaded	10–25	–
Crusher (not rock)- unloaded	25–75	Can be high inertia
Drilling machine- unloaded	10	–
Fan, axial-flow propeller	20–40	–
Feeder- screw	100–175	Needs high starting torque motor
Feeder- vibrating, motor driven	100–150	Needs high starting torque motor
Grinder- unloaded	10–25	Usually high inertia
Hammer mill	20–125	Eccentric load, needs high starting torque
Mills- flour etc.	30–50	–
Mixer- dry contents	35–75	–
Mixer- fluid contents	10–40	–
Mixer- plastic contents	75–125	High torque motor offers advantage
Mixer- powder contents	75–125	High torque motor offers advantage
Pelletizers	50–100	–
Press, flywheel	50–150	Needs high starting torque motor
Pump- centrifugal	10–25	Soft stopping useful
Pump- positive displacement, piston type	100–175	Needs high starting torque motor
Pump- vane type, positive displacement	100–150	Needs high starting torque motor

8. Applications (continued)

Table 8.2.1– Applications (continued)		
Application	Breakaway Torque (%FLT)	Remarks
Rolling mill	30–50	–
Saw, band	10–35	–
Saw, circular	25–50	May be high inertia; Plug brake may be useful
Screen, vibrating	30–60	–
Transformers, voltage regulators	Nil	Change firing mode
Tumblers	30–100	Can be eccentric load, may need high torque

8.3 Concepts and principles of fixed-speed induction motor starting and control.

Since it's invention one hundred years ago, the standard 3-phase induction motor has become one of the most familiar items of industrial equipment ever known. Due to its simplicity of construction, low cost, reliability and relatively high efficiency, it is likely to remain the prime source of mechanical energy for the foreseeable future.

8.3.1 Introduction

Energy conversion, from the electrical supply to rotating mechanical energy, is a characteristic of all motors. To regulate energy flow, most motor circuits require a mechanism to connect and disconnect them from their electrical power source; electro-mechanical switches, known as 'Contactors', are the standard means of achieving this control. Even today, more than one hundred years after their introduction, contactor-based systems remain the most widely used method of motor control. Nevertheless, there is a definite trend towards more sophisticated electronic systems of control being applied to fixed-speed motor drives. This section will discuss these newest forms of control - namely, electronic, microprocessor-controlled, optimising soft-starters such as STS™.

Note: Since there is a wealth of detailed literature available in the technical press, it is not proposed to dwell too heavily on the specifics of realising the electronic control system, but rather, to offer an outline of its various capabilities.

8.3.2 The Induction Motor

In order to appreciate the benefits of using an electronic controller, it is important to have some understanding of the characteristics and limitations of the induction motor and the electro-mechanical systems currently used to control them. The standard, fixed-speed induction motor fulfils two basic requirements:

To accelerate itself and its load to full speed (or speeds with multi-speed motors)
To maintain the load at full speed efficiently and effectively over the full range of loadings.

Due to the constraints of materials and design, it can be difficult to achieve both objectives effectively and economically in one machine. So, how does a motor start in the first place? As mentioned earlier, motors convert electrical energy drawn from the power supply into a mechanical form, usually as a shaft rotating at a speed fixed by the frequency of the supply. The power available from the shaft is equal to the torque (moment) multiplied by the shaft speed (rpm). From an initial value at standstill, the torque alters, up or down, as the machine accelerates, reaching a peak at about two thirds full speed, finally to become zero at

8. Applications (continued)

8.3.2 The Induction Motor (continued)

synchronous speed. This characteristic means that induction motors always run at slightly less than synchronous speed in order to develop power - the 'slip speed' and, hence the term asynchronous. The following graph is of an induction motor torque/speed curve and illustrates this most important characteristic.

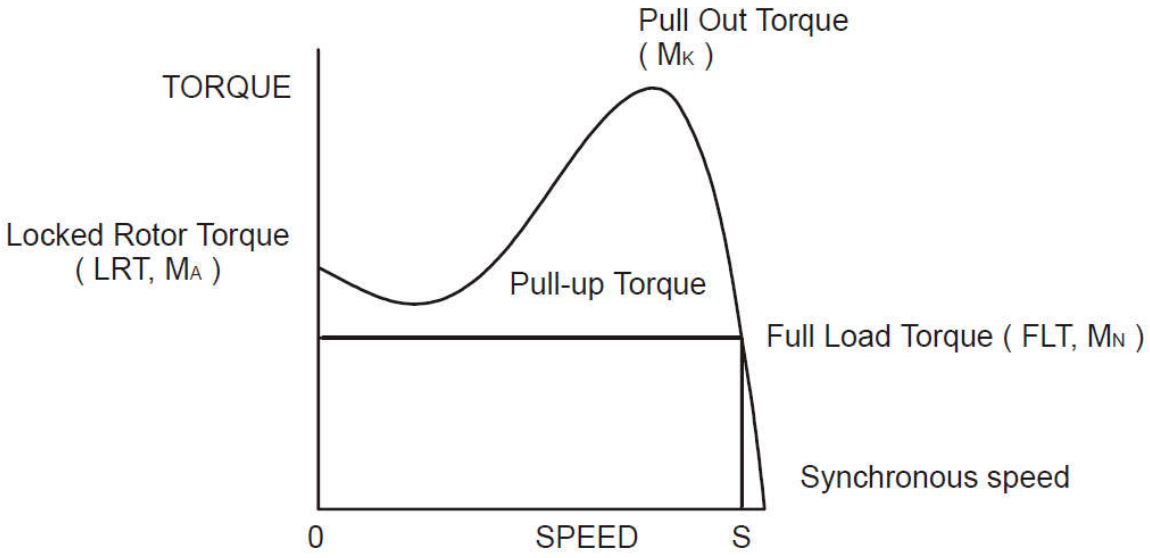

Figure 8.3.1: Torque/Speed Curve – Induction Motor

As for each type of motor, so each load coupled to an induction motor has its own speed/torque curve:

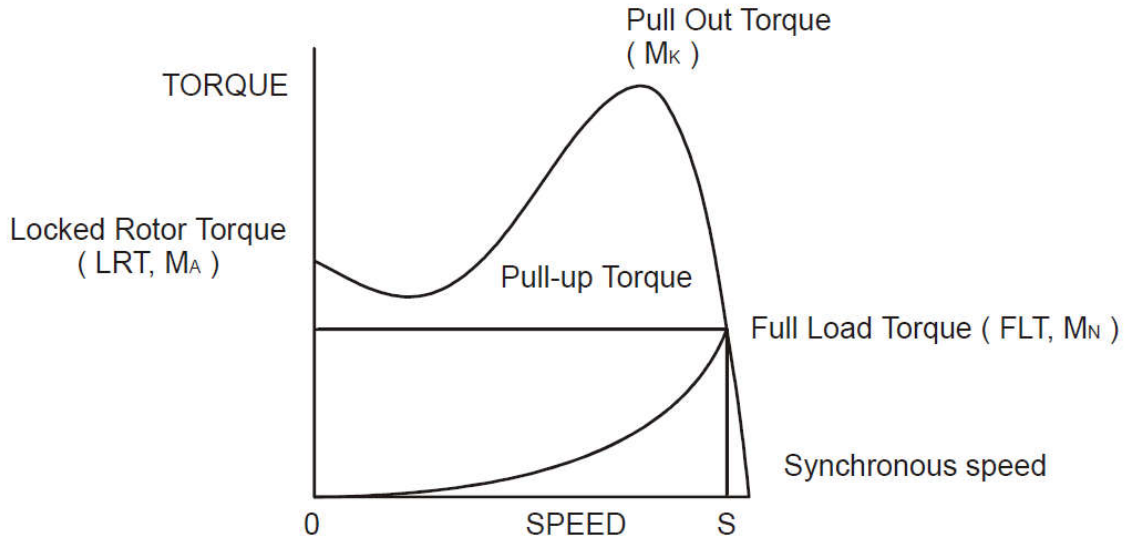

Figure 8.3.2: Torque/Speed Curve – Coupled Load

8. Applications (continued)

8.3.2 The Induction Motor (continued)

The acceleration of a motor-load system is caused by the difference between the developed torque (motor) and the absorbed torque (load), and is shown by the shaded area in the next figure:

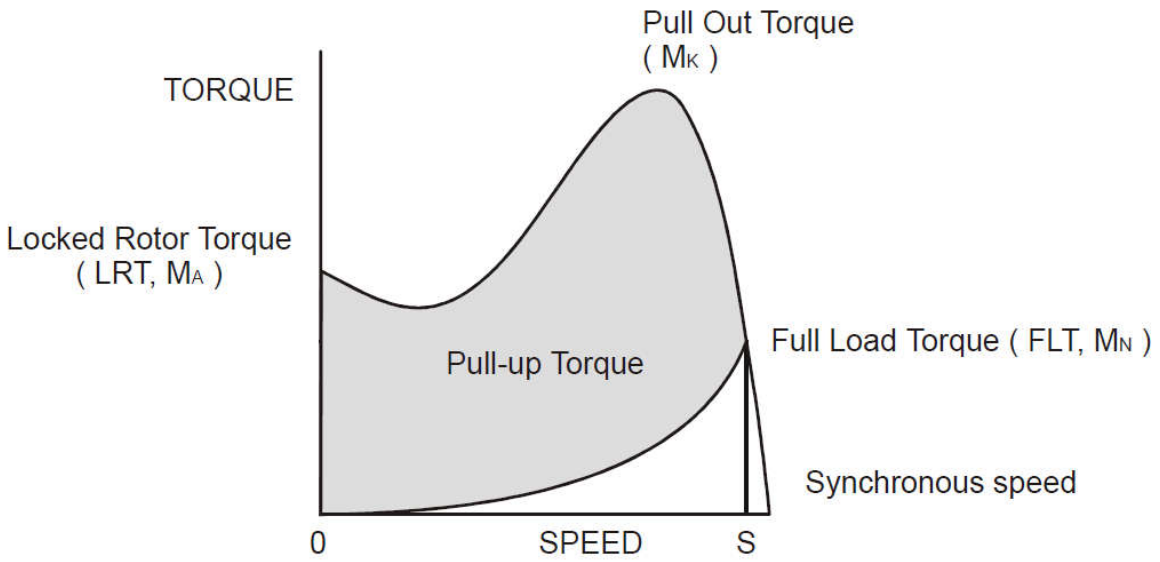

Figure 8.3.3: Torque/Speed Curve – Accelerating Torque

Obviously, the larger the difference, the faster the acceleration and the quicker full speed is reached - and, coincidentally, the greater the stresses experienced by the supply and drive systems during the acceleration process. An "ideal" start would accelerate the load with just sufficient force to reach full speed smoothly in a reasonable time, and with minimum stress to the supply and drive mechanisms.

Broadly speaking, the motor speed/torque characteristic is controlled by the rotor resistance - a motor with high rotor resistance can generate it's peak torque (pull-out torque) at standstill giving the high break-away torque characteristic, which reduces steadily as the speed increases and becoming zero at synchronous speed. At the other end of the scale, a motor with a very low rotor resistance will produce a low starting torque but will generate its peak torque closer to the synchronous speed. Consequently this type of motor runs at full power with higher operating efficiency and low slip speed. It is possible to combine the twin requirements of high starting torque and efficient full-speed operation within a single motor by techniques such as double-cage or deep bar design, and this, usually, is the motor characteristic chosen for lifting and hoisting applications:

(see over)

8. Applications (continued)

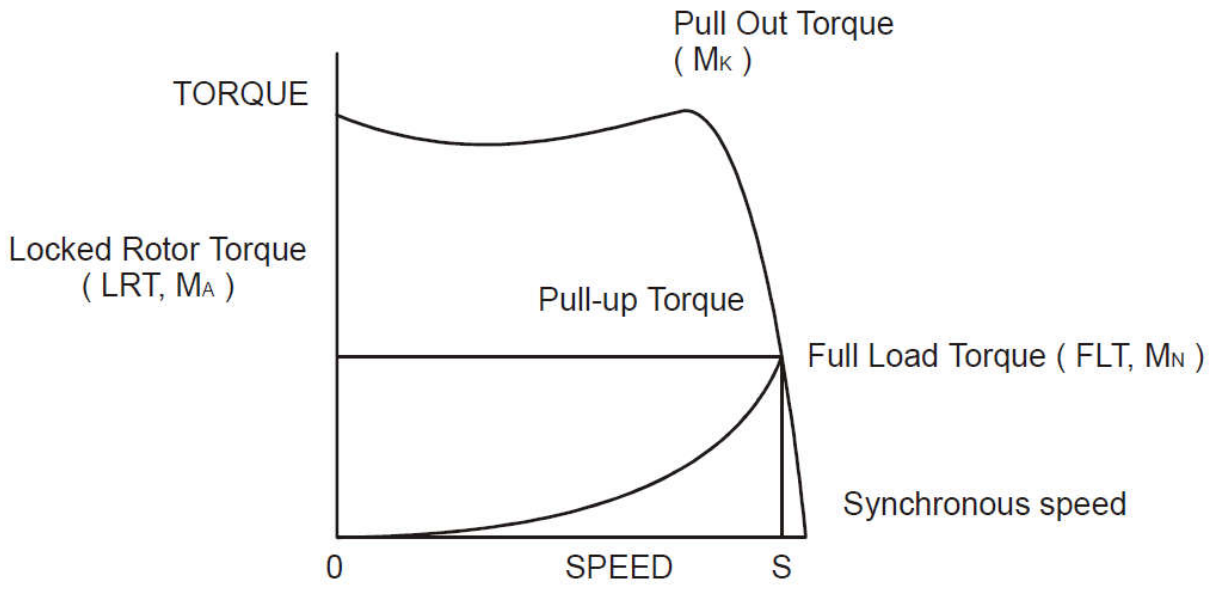

Figure 8.3.4: Torque/Speed Curve – High Starting Torque

However, most induction motors are designed to have a "standard" characteristic that provides a compromise between starting torque and operating efficiency. To summarise, an induction motor will only start and accelerate when it produces more torque than the connected load absorbs. This is true for all speeds - including standstill and full speed.

8.3.3 Starting Induction Motors

Starting a de-magnetised induction motor from standstill is a demanding and complex process. At the instant of switching all the energy necessary to magnetise the motor, to provide the acceleration force, and to supply the kinetic energy of the rotor and load, must be present together with the energy to overcome the mechanical and electrical losses. To do so at full supply voltage places considerable stresses on the supply, the motor windings, and the iron cores of the stator and rotor. Excessive acceleration of a rotor when the mechanical load is small can produce torque oscillations in the shaft causing severe wear to transmissions, gears and drives. Excessive acceleration when the load inertia is high such as in centrifugal fans, causes belts to slip in the pulleys, producing rapid wear and early failure.

8.3.4 Electro-Mechanical Methods Of Starting

Method A: Direct-on-Line

The most simple means of controlling energy flow to an induction motor is to interrupt the power supply by a single, solenoid operated, 3-phase switch, known as a contactor. Very widely applied, the method is known variously as "direct-on-line", "across-the-line", "direct" etc., and is the usual form of control where low cost is the first, and most important consideration. As a result, it is most often used on small motor sizes (up to approx. - 22kW), or where the supply is strong enough to withstand the inrush and starting current surges without causing unacceptable voltage drops.

The harsh, damaging effects described earlier are all imposed by direct-on-line starting and, as a control method, it is the most destructive of equipment. Its simplicity and apparent low cost, although attractive at first sight, hide large cost penalties in the shape of increased maintenance, reduced transmission

8. Applications (continued)

8.3.4 Electro-Mechanical Methods Of Starting (continued)

equipment life and higher risk of motor failure, particularly when frequent starting and stopping is needed. In larger sized motors special strengthening is necessary, at higher cost, before they can be safely used with direct-on-line starting. However, the shortcomings of the direct-on-line starter have been recognised ever since motors have been used and alternative systems have been developed over the years to reduce the damaging effects of this form of control.

Method B: Star-Delta and other Reduced Voltage Starting Systems
Reduced voltage starting makes use of the fact that motor torque is proportional to the square of the terminal voltage; the most familiar type of reduced-voltage starter is the star-delta starter. Consisting of three contactors and a time switch (which can be mechanical, pneumatic, electrical or electronic), the star-delta starter changes the motor winding configuration from an initial star connection to a delta as the motor accelerates. The change-over or transition point is controlled by the time switch and is usually arranged to be approximately at 80% of full speed. The effect of starting in star is to alter the voltage across each stator winding to 58% of normal. This reduces the starting torque to a third of locked rotor torque (LRT) with a consequent reduction in starting currents and acceleration forces.

Although an apparent improvement over the direct system, significant disadvantages still remain. The transfer from star to delta momentarily removes the motor from the supply. During this time the motor is under the mechanical influence of the rotating load and, at the instant of disconnection, current will still flow in the rotor bars due to the time delay necessary for the magnetic flux to die away. Therefore, there is a residual flux “frozen” on the surface of the rotating rotor, which cuts the stator windings, generating a voltage whose frequency depends on the rotor speed. If the load inertia is small, such as in a pump, or if the friction is high, there could be a significant loss of speed during the time the supply is disconnected.

In this case, when the reconnection to delta is made, a large phase differential can exist between the supply and the rotor fluxes. This can give rise to very large current surges (as much or more than full-voltage locked rotor current), together with massive transient torque oscillations, which can peak at levels in the region of fifteen-times full-load torque. Although the effects described are only present for a very short period of time (about one fifth of a second), they are sources of great stress and damage to the whole drive system, and where frequent starting is necessary, invoke high maintenance costs. The current surges, in the form of a very high level short duration “spikes”, are an increasing problem in these days of computer control systems and other “sensitive” electronic equipment. The voltage disturbance on the supply is very difficult to filter out and can cause severe problems, especially when larger motors are involved.

There are methods of control, for example, the Wauchope starter, which eliminate or reduce the reconnection transients. However, such starters are expensive and have reliability implications; for these reasons they are not widely applied.

The star-delta starter also has disadvantages due to the restricted starting torque available (if you need 40% LRT to break-away, you can only increase the motor size, or revert to direct-on-line). Combined with the severe effects of the re-switching surges, and the additional costs of bringing six conductors from the motor to the starter instead of only three, star-delta only offers an imperfect solution to the problem of starting the induction motor.

Method C: Primary Resistance Starter
It has long been recognised that the transition step in the star-delta system was a source of problems such as welded contactors, sheared drive shafts etc., and for many years a method of stepless control has been available in the form of the primary resistance starter.

8. Applications (continued)

8.3.4 Electro-Mechanical Methods Of Starting (continued)

This type of controller inserts a resistance in one, or more often in each, of the phase connections to the stator at start-up, after which it is progressively reduced and shorted out at the end of the acceleration process. Frequently, the resistances are movable blades that are gradually inserted into an electrolyte liquid. The mechanism is usually large and expensive, both to purchase and to maintain, and considerable heat is created by the passage of current through the electrolyte resistor. This limits the starting frequency (because the electrolyte has to condense back to liquid before a new start can proceed), and these restrictions prevent this starter from being a popular option when selecting a control system. However, it has the distinction of being the smoothest and least stressful method of accelerating an induction motor and its load.

Method D: Other Electro-Mechanical Systems
Other control methods such as auto-transformer starting (popular in North America), primary reactance starting etc., are employed to a greater or lesser extent, to compensate for some of the disadvantages of each type of starter discussed. Nevertheless, the fundamental problems of electro-mechanical starters remain, and it is only in the last decade or two that their dominance has been challenged by the introduction of power semiconductors controlled by electronics.

8.3.5 The Semiconductor Motor Controller

During the 1950's, much effort was put into the development of a four-layer transistor device which had the power to switch large currents at high voltages when triggered by a very small pulse of current. This device became known as the silicon controlled rectifier (SCR), or in Europe, the 'Thyristor'; it is the basis on which all soft starting systems are built. The characteristic of most interest is the ability of the thyristor to switch rapidly (in about 5 millionths of a second) from "OFF" to "ON" when pulsed, and to remain "ON" until the current through the device falls to zero, - which conveniently, happens at the end of each half-cycle in alternating current supplies.

By controlling the switch-on point of a thyristor relative to the voltage zero crossing in each half wave of an alternating current, it is possible to regulate the energy passing through the device. The closer the turn-on point is to the voltage zero crossing point, the longer the energy is allowed to flow during the half-cycle. Conversely, delaying the turn-on point reduces the time for the energy to flow. Putting two thyristors back-to-back (or anti-parallel) in each of the phase connections to a motor, and by precisely controlling their turn-on points, an electronic soft starter continuously adjusts the passage of energy from the supply so that it is just sufficient for the motor to perform satisfactorily.

So, for instance, by starting with a large delay to the turn on point in each half cycle, and progressively reducing it over a selected time period, the voltage applied to the motor starts from a relatively low value and increases to full voltage. Due to the motor torque being proportional to the square of the applied voltage, the starting torque follows the same pattern giving the characteristic smooth, stepless start of the soft-starter.

8.3.6 Running Induction Motors

Once a start has been completed the motor operating efficiency becomes of interest. When working at or near full load, the typical 3-phase induction motor is relatively efficient, readily achieving efficiencies of 85% to 95%. However, as shown below, motor efficiency falls dramatically when the load falls to less than 50% of rated output.

8. Applications (continued)

8.3.6 Running Induction Motors

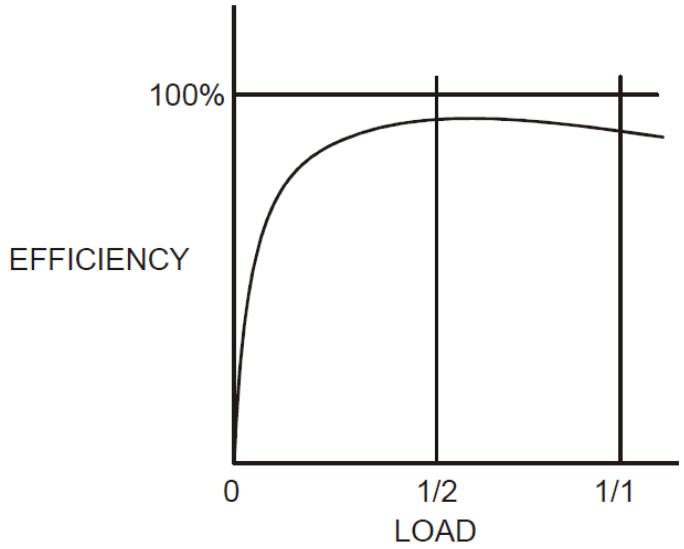

Figure 8.3.5 Motor Efficiency/Load Characteristic

In fact, very few motors actually experience consistent fully rated operation, the vast majority operate at much lower loads due to either over-sizing (a very frequent situation), or natural load variations. For Fan and Pumping applications, the affinity laws will allow the inverter drive to show very considerable energy savings over virtually all other methods of control through varying the speed of the motor in response to changes in load. Where motor speeds cannot be varied, an optimising version of semiconductor motor controller, such as STS™ will also produce energy savings in lightly loaded motors. Less sophisticated systems of soft-starter remain at full conduction and the motor then behaves as if it were connected directly to the mains supply. However, at light loads and mains voltages, induction motors always have excess magnetic flux, and efficiency loss and power factor degradation result. By detecting the load at any instant, and adjusting the motor terminal voltage accordingly, it is possible to save some of the excitation energy and load loss, and improve motor power factor when the motor is running inefficiently at light loads.

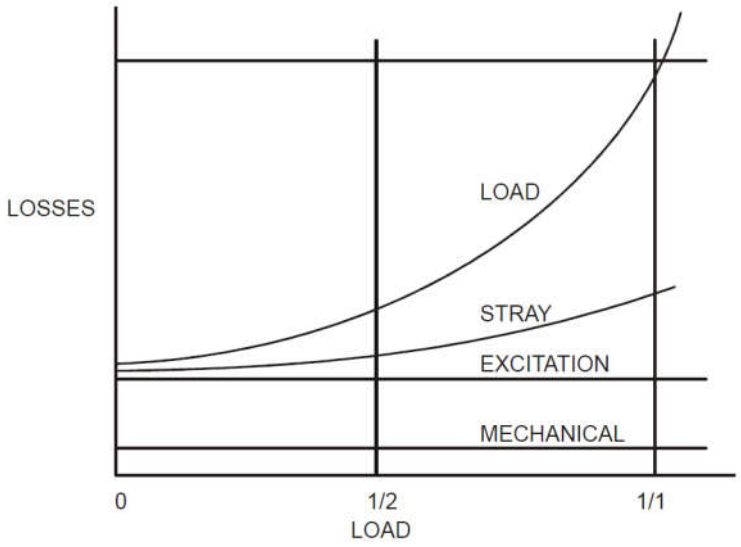

Figure 8.3.6: Motor Efficiency/Loss Characteristic

8. Applications (continued)

8.3.6 Running Induction Motors (continued)

All STS™ soft-starters are microprocessor controlled, and this gives them a number of advantages. Firstly, there are no adjustments to be made for the energy saving function: all calculations necessary to find the best degree of phase-back of the thyristors for any load condition is made by the microprocessor. Secondly, the start always synchronises with the supply voltage and a special structure of turn-on pulses virtually eliminates the inrush currents normally associated with motor start-up; this happens every time. Lastly, there is the absolutely stepless starting process, found only with the primary resistance or reactance electromechanical starters - but without the wasted energy, and with the opportunity to control the maximum current allowed to flow during the starting process. Other features such as soft stopping are included to give considerable control over all modes of induction motor operation.

8.3.7 Reliability Considerations

An aspect of electronic controllers for induction motors which is of increasing concern is that of reliability. There is little point in installing an expensive item of electronic equipment to save potentially considerable amounts of money if the device is unreliable to the point that vital processes are constantly interrupted.

There are electronic products in the market place which appear to offer soft starting cheaply. They almost always rely on less advantageous technologies such as analogue control, or half-control, where one of the two thyristors in each phase is replaced with a diode. There are systems which only control the energy flow in one phase while the other two are directly connected. Owing to the variable quality and performance of many so-called inverters and soft-starters available to the unsuspecting purchaser, international standards for these products have been developed.

So far, IEC 60947-4-2 - 'AC Semiconductor Motor Controllers and Starters' defines the soft starter in every important respect, including thermal and overload performance as well as electromagnetic compatibility. By ensuring that any motor controller equipment purchased conforms to IEC 60947-4-2, a user should be reasonably safeguarded from shoddy or inadequate products when specifying equipment for future installations. A particular advantage of the use of the optimising soft starter is its impact on the maintenance requirements of associated electro-mechanical equipment. Optimising lowers the surface temperature of the motor by reducing the losses within the motor. This prolongs the motor life - and reduces heating of the surrounding atmosphere in the process. If the atmosphere is subject to air conditioning, reducing the heat input will reduce the air conditioning costs. Reduced starting and running currents reduces cable losses and, contactor switching operations are carried out under the most advantageous conditions. No current flows on switch-on since all switching is carried out by the thyristors - virtually eliminating the need for contact replacement.

Indeed, there are a growing number of installations where contactors are no longer employed, being replaced by controllable circuit breakers or isolators instead.

In summary, electronic controllers for most fixed-speed applications are opening new ways of increasing the efficient operation of induction motors, as well as offering significant benefits in control. Intending users need to ensure themselves of the quality and performance of any products they expect to fit and this can be reasonably expected if compliance with the appropriate IEC standards is demanded.

9. EMC

Chapter 9

9 Electromagnetic Compatibility (EMC)

As supplied, all STS Soft Starters meet the standards of emission and immunity levels defined in the IEC 60947-4-2 and EN 60947-4-2 product standards for AC Semiconductor Motor Controllers and Starters. However, the EMC performance of the controller can be significantly affected by the manner in which it is incorporated into the system in which it is intended to operate. To prevent inadvertent degradation of EMC performance, attention must be given to motor cable lengths, wiring configurations, the nature of the power supply, etc., at the design, construction and implementation stages of a project.

9.1 Introduction

It is widely accepted that electromagnetic compatibility between electronic and electrical products is a desirable objective. Technical standards are increasingly stipulating levels of EMC performance which compliant products are required to meet. The decision by the European Union (EU) to implement a community-wide directive covering EMC caused considerable activity among electrical and electronic equipment manufacturers and suppliers to identify, understand, and mitigate the sources of electromagnetic interference within their products and systems.

9.2 Applicable Standard Within the EU

The product standard which defines EMC performance for soft starters is IEC 60947-4-2 'AC Semiconductor Motor Controllers and Starters.' (The Official Journal of the EC will list this standard as EN 60947-4-2.). STS™ has been type tested in accordance with the test procedures and levels laid down in the product standard.

9.3 Mandatory Requirements Within the EU

(Applicable to any person involved in the installation and operation of the equipment.)

The EU Directive 2004/108/EC, describes the required EMC performance of all electrical equipment which is to be connected to a low voltage supply network. It imposes an obligation on the manufacturer of the soft starter to provide sufficient information for installers, system integrators, users, and anyone else connected with the installation and operation of the equipment. This section provides the technical information to support the obligation of the manufacturer.

The provision and maintenance of compatibility extends from the manufacturer to the panel builder, assembler, systems integrator, and ultimately to the installer and user. Anyone involved in the installation and operation of the equipment, through a lack of knowledge, misdirection, or for other reasons, can completely negate the initial EMC performance of the equipment.

9.4 Guidance for Installation Personnel and System Designers

For safety reasons, all STS™ products are intended to be installed and set to work by skilled personnel who are capable of interpreting and following EMC guidelines correctly. Any person not fully trained in the appropriate technology should not attempt the installation.

If you do not understand, or if you are unclear about any part of these guidelines, then please consult your supplier. Often, consultation with the supplier can avoid unnecessary problems in specifying and installing the correct combination of equipment.

9. EMC (continued)

9.5 EMC Basic Criteria

The electromagnetic compatibility of a product is defined by two criteria:

1. Immunity to electromagnetic disturbances generated externally to the product.
2. The type and amount of conducted and radiated electromagnetic emissions emanating from the product.

Ascertaining the nature of the power supply is of primary consideration when deciding on appropriate EMC requirements. The requirements for equipment installed in heavy industrial environments (fed from their own isolated low voltage power supply) differ from those installed in residential, commercial, light industrial, and health-care applications (directly connected to a public low-voltage network).

Generally, industrial installations require higher immunity levels and permit higher levels of conducted and radiated emissions than those for non-industrial installations. On the other hand, lower levels of emissions output, and lower immunity levels, are specified for installations connected directly to the public low-voltage network.

9.6 Purchasing Implications of Meeting an EMC Standard

Before purchasing components for the installation, the specifier must evaluate the expected source of power for the Soft Starter and understand exactly the implications for meeting EMC requirements. It is likely that failure to do so will result in the purchase and installation of inappropriate equipment.

IMPORTANT: The information and guidance given in section C.7 forms part of the statutory requirements of the European Union Directive 2004/108/EC on EMC

9.7 Basic EMC Considerations

9.7.1 Immunity

The product standard for immunity requirements is EN 60947-4-2:2012. All STS™ Soft Starter products meet, or exceed the industrial level immunity requirements laid down in this standard.

9.7.2 Emissions

Emissions are classified as low frequency (below 9kHz), known as harmonics, and high or radio frequency (above 9kHz). Both radio-frequency emissions and low-frequency harmonics are generated by the action of the STS™ Soft-Starter.

NOTICE: This product has been designed for environment A. Use of this product in environment B may cause unwanted electromagnetic disturbances in which case the user may be required to take adequate mitigating measures.

9.7.3 Emissions - Harmonics

During normal operation, soft starters turn their semiconductor switches on and off in order to vary the voltage at the motor terminals, and this introduces supply discontinuities and generates harmonics. However, the mode of pulsing used by STS™ Soft Starters minimizes these harmonic effects, since STS™ power circuits are configured as a fully-controlled regulators (W3C).

9. EMC (continued)

Only non-triplen (integer multiples of the third harmonic), odd harmonic frequencies are created, starting with and diminishing rapidly from the fifth harmonic, and virtually disappearing by the nineteenth harmonic.

9.7.4 Emissions - Radio Frequency (RF)

Radio frequency emissions are propagated in two ways:

a) Conduction along the leads supplying the soft starter.
b) Radiation from the operating equipment.

They also have two sources:

1) The high-frequency currents associated with the control electronics (this includesthe microprocessor).
2) The action of the semiconductor devices forming the power switching elements located in the controller main circuits.

The radiation measurements made from operating versions of STS™ Soft Starters show levels lower than the allowed limits. Further, enclosures of metallic construction provide additional shielding for STS™ Soft Starters mounted within them. The only radiated interference effect that might arise from a soft starter would be if mobile telephones, walkie-talkies, etc. were to be used in very close proximity to a unit which was operating with the enclosure door open. For this reason, any enclosure must display a label that brings the possibility of electromagnetic interference to the attention of the operator under these circumstances.

9.7.5 Emissions - Conducted

Conducted emissions are able to travel great distances and may cause interference to any neighboring consumers connected to the common low-voltage supply network.

Allowable levels for conducted emissions generated by semiconductor motor controllers and starters are influenced by the nature of the low-voltage power distribution network. The determining factor is whether the source of power is, either:

a) a private supply with a single consumer whose Point of Common Coupling (PCC) is at a high or medium voltage transformer, or
b) a public low-voltage network with more than one consumer, where the individual PCC is made directly to the network itself.

The first type of supply (a) is identified as “Industrial”, and requires the use of soft starters compliant with EN 60947-4-2 Table 19 Environment A Emission Levels.

The second type of supply (b) is identified as “Residential” and requires the use of Class B equipment. Class B equipment is equipment suitable for use in domestic establishments and in establishments directly connected to a low-voltage power supply network which supplies buildings for domestic purposes.

9.7.6 Important Systems Information

The specification limits for both equipment classes assume systems are grounded at the star (wye) point of the supply transformer through low impedance connections.

Certain industries, particularly continuous process industries, employ distribution systems that operate either with a ground connection through a high impedance or without a ground at all. These systems may cause severe problems of operator safety when installed with capacitive high frequency filters. Such systems are not considered in this document.

9. EMC (continued)

In the case of an isolated or high impedance grounded system, seek advice from your supplier before fitting a capacitive high frequency filter to a STS™ Soft Starter. It is essential that the specifying authority, user, or installer has a clear knowledge of the type of network to which the product is to be installed before making decisions as to which EMC strategy to adopt.

As supplied, all STS™ products comply with the conducted emissions requirements for environment class A as defined by EN 60947-4-2:2012 Table 19. However, the length and type of cable connecting the motor to the starter module materially affects the level of emissions generated, and can amplify them greatly. The standard also allows different levels of emissions depending on rated input power, which also affects the need to fit filters. The EN 60947-4-2:2012 standard only requires consideration of steady-state conditions for EMC emission purposes, and expressly excludes varying conditions such as those during ramp-up and ramp-down.

Finally, statistics show that the number of disturbances arising from soft starters, operating in a very wide variety of applications and networks throughout the world, is insignificant. Where EMC disturbances occur, it is very unlikely that they can be genuinely attributed to a soft starter.

9.7.7 Strategies for Attaining and Maintaining EMC Compliance

Where possible, minimize the effect of electrical interference by using the strategies listed below.

- Locate the STS™ Soft Starter unit as close as reasonably possible to the motor terminal box in order to minimize cable length.
- Ensure that, within any enclosure, the control wiring does not run parallel to the power wiring. Where this is unavoidable, maintain a 100 mm [3.9 in] separation between control cables and power cables.
- Where possible, ensure that the control wiring crosses at right angles to the power wiring. This practice reduces the cross-coupling between cables.
- Shield any cables carrying sensitive signals. The digital control inputs to a STS™ are opto-isolated, and do not normally require buffering (e.g. through a small relay) or shielding.

Where a special purpose system filter has been applied at the point of common coupling, additional filtering of individual drives is not necessary and may introduce undesirable effects due to resonance.

For the purposes of EMC, the connections between the STS™ controller and motor are considered to be an extension of the enclosure, and preferably should be contained within grounded metallic trunking or conduit. Armored cable may be used providing it is correctly terminated, although the EMC performance will be slightly inferior. Shielded cable is not necessary.

All associated electrical and electronic equipment near to the controller complies with the emission and immunity requirements of the EMC Directive.

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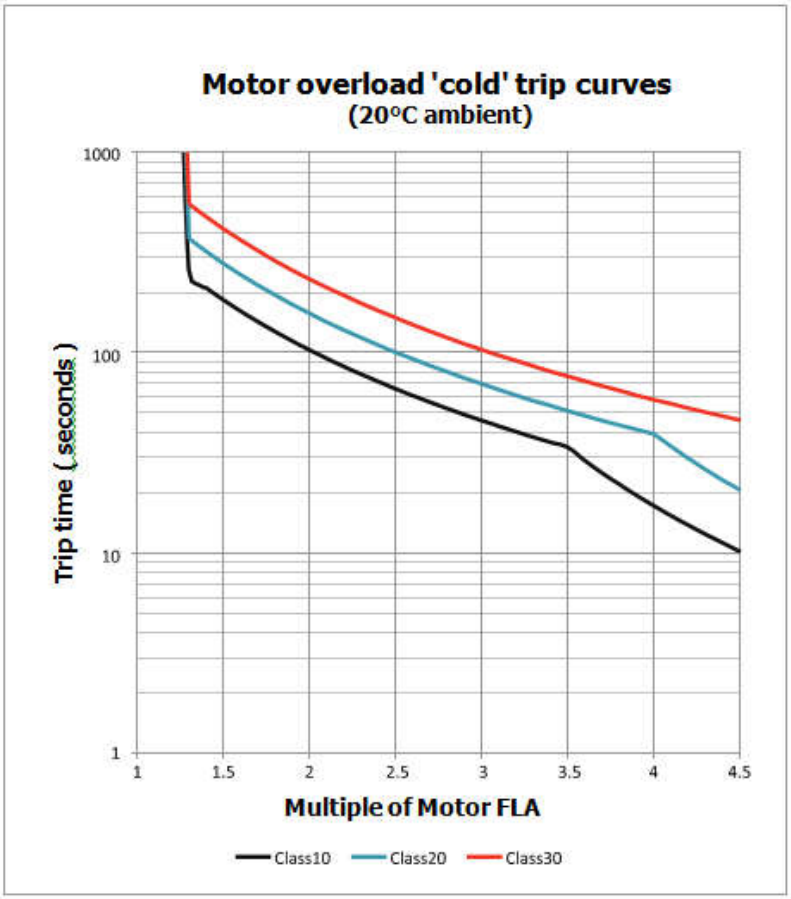
A1. Soft Starter Sizing

Appendix 1

A1.1 Introduction

STS™ provides full motor overload protection, configurable through the user interface. Overload trip settings are determined by the Motor Current setting and the Trip Class setting. Trip class choices are Class 10, Class 20, and Class 30. The STS soft starters are protected using full I^2T motor overload with memory.

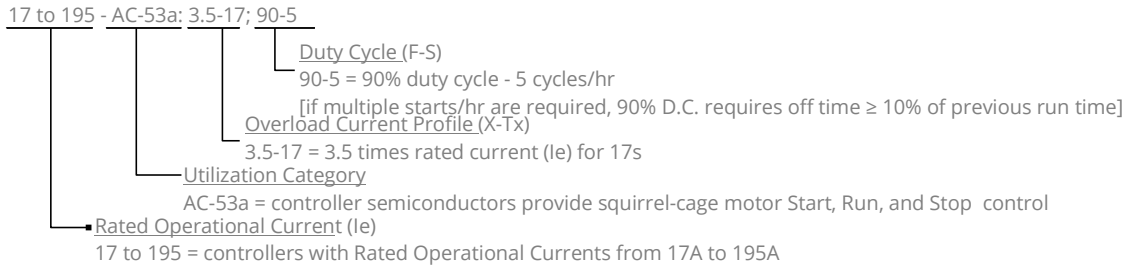


A1. Soft Starter Sizing (continued)

A1.2 Index Rating

STS Index Ratings *		
Model Number	I_e (A)	Standard Operation AC-53a; X-
STS-101 to STS-205	17 to 195	AC-53a: 3.5-17; 90-5
STS-301 to STS-309	242 to 500	AC-53a: 3.5-17; 90-3
STS-401 to STS-505	610 to 1080	AC-53a: 3.5-17; 60-3
* Index ratings AC-53a and AC-53b are specified by IEC standard # 60947-4-2. IEC Index Ratings are comprised of Rated Operational Current (I_e), Utilization Category, Overload Current Profile (X-Tx), and Duty Cycle (F-S) or OFF-time.		

Index Rating Example – Standard Operation (AC-53a Utilization Category per IEC 60947-4-2)



A1.3 Standard Overload Current Profile and Duty Cycle

STS™ has been designed for a specific Overload Current Profile and Duty Cycle as shown in the previous STS™ Index Ratings section of this chapter.
The Overload Current Profile is expressed by two symbols, X and Tx.
X denotes the overload current as a multiple of I_e and represents the maximum value of operating current due to starting, operating, or maneuvering under overload conditions.

- For example, X = 3.5 means that the maximum overload start current allowed is 3.5 times FLC.

Tx denotes the duration of the controlled overload currents during starting, stopping, operating, or maneuvering.

- For example, Tx = 17 means that the maximum allowed overload current is permitted for up to 17 seconds only.

The Duty Cycle is expressed by two symbols, F and S which describe the duty and also set the time that must be allowed for cooling.
F is the ratio of the on-load period to the total period expressed as a percentage.

- For example, F= 90 means that the soft starter is ON for 90% of the time and then OFF for 10% of the time between each start.
- If there are not multiple starts per hour, then the Duty Cycle is continuous.

S is the number of starts or operating cycles per hour.

- For example, S = 5 means that the soft starter is capable of 5 equally spaced starts per hour.

These characteristics are summarized in the Figure overleaf.

A1. Soft Start Sizing(continued)

A1.3 Standard Overload Current Profile and Duty Cycle (continued)

Standard Overload Current Profiles and Duty Cycles					
Model	Rated Current (A)	Class 10 O/L Multiple (X)	Class 10 O/L Time (Tx)	Starts / Hour (S)	Duty (F)
STS-101	17	3.5	17	5	90%
STS-103	22				
STS-105	29				
STS-107	35				
STS-109	41				
STS-111	55				
STS-113	66				
STS-115	80				
STS117	100				
STS-201	132				
STS-203	160				
STS-205	195				
STS-301	242			3	
STS-303	302				
STS-305	361				
STS-307	430				
STS-309	500				
STS-401	610				
STS-403	722				
STS-501	850				
STS-503	960				
STS-505	1080				

A1. Soft Start Sizing(continued)

A1.4 Sizing Chart

Step 1 - Select the application from the list and follow that column down.	Typical Applications	Standard Duty	Medium Duty	Heavy Duty
		Agitator	Compressor - Centrifugal	Crusher
		Compressor - Rotary Vane	Compressor - Reciprocating	Shredder
		Compressor - Scroll	Compressor - Rotary Screw	Wood Chipper
		Bow Thruster - Zero Pitch	Ball Mill	Fan - High Inertia >85A
		Fan - Low Inertia	Bow Thruster - Loaded	
		Feeder - Screw	Conveyor - Loaded	
		Lathe Machines	Grinder	
		Moulding Machine	Hammer Mill	
		Plastic and Textile Machines	Mills - flour etc.	
		Pump - Submersible	Mixer - Loaded	
		- Centrifugal	Pelletizers	
		Pump - Submersible	Press, Flywheel	
		- Rotodynamic	Positive Displacement Pump	
		Saw - Band	- Reciprocating	
		Transformers	Positive Displacement Pump	
		Voltage Regulators	- Rotary	
			Pump Jack	*For centrifuges make selection at I(A) = motor FLA x 2.3*
			Rolling Mill	
			Roots Blower	
			Saw - Circular	
			Screen - Vibrating	
			Tumblers	
Step 2 - Confirm the rated starting capability of the soft start against the application.	Trip Class	Trip Class 10	Trip Class 20	Trip Class 30
	Rated Starting Capability	3x Motor Current - 23secs	4x Motor Current - 19secs	4x Motor Current - 29secs
		3.5x Motor Current - 17secs		
	Max Starts per Hour	5 starts/hour	5 starts/hour	5 starts/hour
		or 3 starts/hour	or 3 starts/hour	or 3 starts/hour
Step 3 - Consider the operating environment and make the model selection on a higher horsepower rating.	Height Above Sea Level	Standard operating height is 1000m, for every 100m increase motor Amps/kW/HP by 1%, up to 2000m.		
		Example: For a 100A motor at 1500m make model selection based on 105A (5% higher)		
	Operating Temperature	Standard operating temperature is 50degC, for every 1degC above, increase motor Amps/kW/HP by 4%, up to 60degC.		
		Example: For a 100A motor at 55degC make model selection based on 120A (20% higher)		
	Increased Starts per Hour	Use our online tool to select the model.		

A1. Soft Start Sizing(continued)

A1.4 Sizing Chart (continued)

	Motor Rating In Line				Motor Rating In Delta						
	400V		460V		400V		460V		Select Model	Select Model	Select Model
	kW	I_e(A)	HP	I_e(A)	kW	I_e(A)	HP	I_e(A)	5 starts/hour @ 50°C	5 starts/hour @ 50°C	5 starts/hour @ 50°C
	7.5	17	10	17	15	29	20	29	SGY-101	SGY-103	SGY-105
	11	22	15	21	18.5	38	25	36	SGY-103	SGY-105	SGY-107
	15	29	20	27	22	50	30	47	SGY-105	SGY-107	SGY-109
	18.5	35	25	34	30	61	40	59	SGY-107	SGY-109	SGY-111
	22	41	30	40	37	71	50	69	SGY-109	SGY-111	SGY-113
	30	55	40	52	45	95	60	90	SGY-111	SGY-113	SGY-115
	37	66	50	65	55	114	75	113	SGY-113	SGY-115	SGY-117
	45	80	60	77	75	139	100	133	SGY-115	SGY-117	SGY-201
	55	100	75	96	90	173	125	166	SGY-117	SGY-201	SGY-203
	75	132	100	124	110	229	150	215	SGY-201	SGY-203	SGY-205
	90	160	125	156	150	277	200	270	SGY-203	SGY-205	↓
Step 4 - Select your motor Voltage and Horsepower and select model.	110	195	150	180	185	338	250	312	SGY-205	↓	↓
	3 starts/hour @ 50°C				3 starts/hour @ 50°C				3 starts/hour @ 50°C	3 starts/hour @ 50°C	3 starts/hour @ 50°C
	90	160	125	156	150	277	200	270	↓	↓	SGY-301
	110	195	150	180	185	338	250	312	↓	SGY-301	SGY-303
	132	242	200	242	220	419	350	419	SGY-301	SGY-303	SGY-305
	160	302	250	302	300	523	450	523	SGY-303	SGY-305	SGY-307
	200	361	300	361	355	625	500	625	SGY-305	SGY-307	SGY-309
	250	430	350	414	425	745	500	717	SGY-307	SGY-309	↓
	280	500	400	477	500	866	600	826	SGY-309	↓	↓
	3 starts/hour @ 40°C				3 starts/hour @ 40°C				3 starts/hour @ 40°C	3 starts/hour @ 40°C	3 starts/hour @ 40°C
	250	430	350	414	425	745	500	717	↓	↓	SGY-401
	280	500	400	477	500	866	600	826	↓	SGY-401	SGY-403
	355	610	500	590	600	1057	800	1022	SGY-401	SGY-403	SGY-501
	400	722	600	722	710	1251	1000	1251	SGY-403	SGY-501	SGY-503
	500	850	700	840	850	1472	1100	1455	SGY-501	SGY-503	SGY-505
	560	960	800	960	950	1663	1250	1663	SGY-503	SGY-505	-
	630	1080	900	1080	1100	1871	1500	1871	SGY-505	-	-

For In-Delta connections, all six motor wires must be available for connection, and it is critical to exactly follow the In-Delta wiring diagram. Nine-lead motors CANNOT be connected in the delta. The Soft Starter will only sense the Phase Current, which is about 58% of the Line Current.

For In-Delta connections, a main contactor that is controlled by the Run relay of STS™ must be used in the incoming power circuit for isolation. Circuit breaker isolation alone is not sufficient.

iERS energy optimizing feature is not available for In-Delta connections.

Appendix 2

A2. Glossary of Terms

Breakaway Torque: The minimum torque required to achieve rotor movement for the motor with its load.

Current Limit: The current at which the ramp is held. For STS™, current limit is only active during start-up where it contributes to the motor control function. This feature is particularly useful when starting high-inertia loads that require an extended start-up period. (See also Overload Level.)

Direct-On-Line (DOL): The direct connection and disconnection of a motor from the AC main supply by means of a contactor or switch. Acceleration and operation is at full mains voltage only.

iERS: intelligent Energy Recovery System. An advanced motor control technology proven to reduce the energy consumed in fixed speed motor applications. It matches the power consumption to the load required by intelligently monitoring and regulating energy consumption, voltage, current, and power factor during the motor starting and running stages. iERS automatically bypasses itself when it is not needed, and continues monitoring to re-engage itself as needed.

Inrush Current or Locked Rotor Current: The current that flows at the instant of connection of a motor to the power source. It is limited by the impedance presented by a de-energized motor and the applied voltage. Usually expressed as a multiple of motor full-load current.

Kick-start Voltage: The percentage of supply voltage applied before commencing ramp-up when a load has a high breakaway torque and the standard settings of pedestal voltage may not allow sufficient torque to be developed by the motor to cause acceleration.

Locked Rotor Current: Same as Inrush Current (defined above).

Overload Level: The level of current at which the controller overload begins to integrate. For STS™, the overload detector is always active and provides protection against prolonged over-current operation.

Pedestal Voltage: The voltage that the unit applies to the motor at start-up. It is expressed as a percentage of the rated supply voltage.

Power Factor: The ratio, expressed as a trigonometric cosine, of the real power consumption to the apparent power consumption.

Top of Ramp (TOR): The unit achieves Top of Ramp (TOR) when it completes the start-up stage of motor control. (This occurs when the voltage applied to the motor first equals the main supply voltage.)

Soft-start: The regulation, by electronic means, of the supply voltage from an initial low value to full voltage during the starting process. This overcomes the inherent drawbacks of a switched supply. The motor torque is modified in proportion to the square of the voltage applied.

Trip: A trip occurs when the unit removes power to the motor because its operation equals the limit imposed by one of its self-protection features.

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Appendix 3

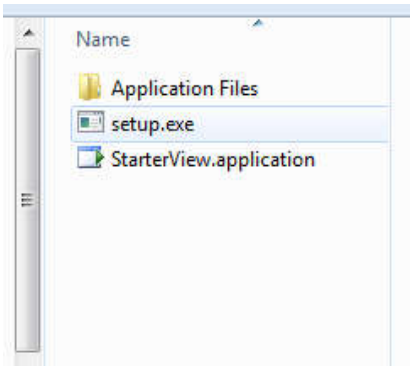
A3. Starter View

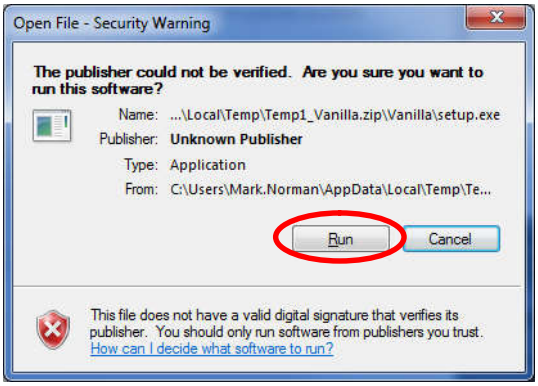
A3.1 Introduction

StarterView is a Windows based program which allows the import, presentation and editing of the parameter and log files produced by STS™ units. Also it includes a utility that aids the firmware upgrading of STS™.

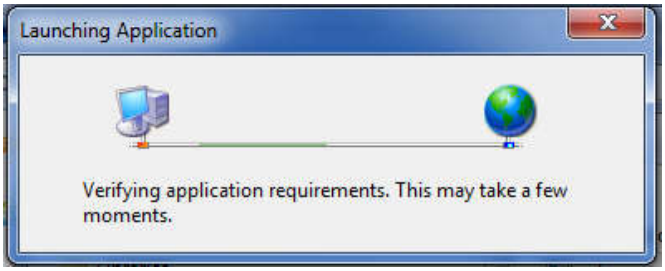
A3.2 Installation

The file will be a windows compressed zip file which can be opened by double clicking it in Windows explorer. Then, within the shown zip folder, double click the setup.exe. This will run the installation.



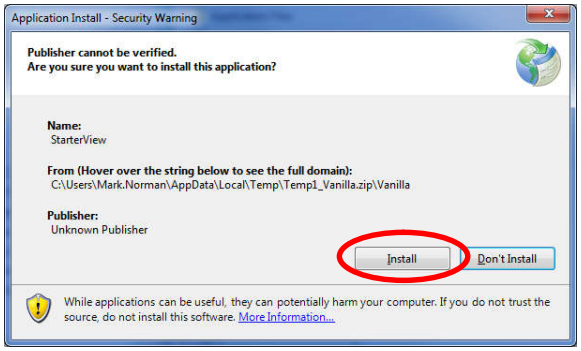


When the first Security warning is displayed, click the run button.



This is a ClickOnce installer and will unpack StarterView onto your Windows computer into the current user folder structure. Because of this it is only available to the current user login.

A Security Warning will appear quoting the destination of the package. Ignore this by pressing install.



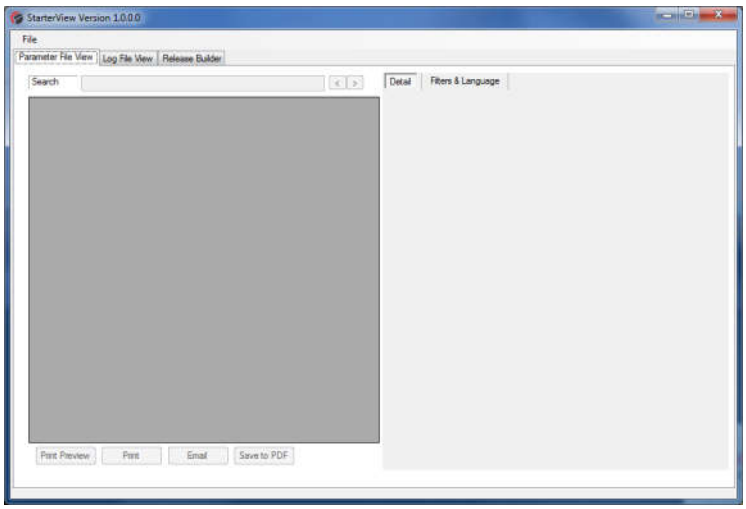
A3. Starter View (continued)

All the required files will be copied there. When completed a short cut to the application will automatically be placed on your desk top and the application will run for the first time.

If the install is an upgrade of an existing StarterView package it may be suspended because Setup blocks subsequent updates from different source directories. If this happens uninstall the existing StarterView (via Windows Control Panel) and repeat the installation.

A3.3 User Interface

Once open, StarterView is ready to use. It always starts up with an image identity, this will be removed when a file is loaded or when the image is clicked, revealing the main user interface.

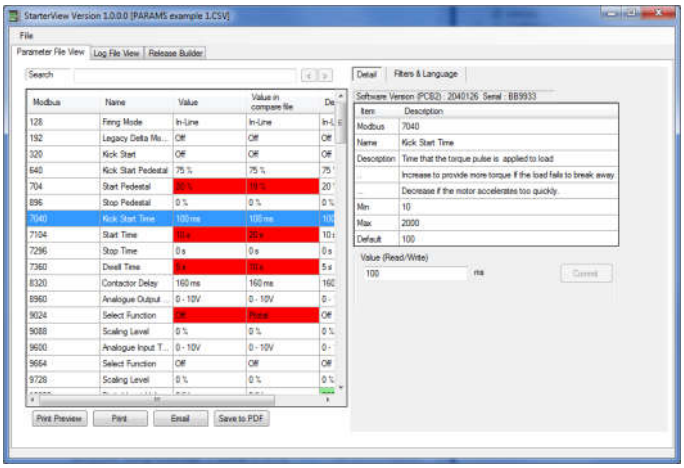


StarterView is a tab based application wherein the three main functions are accessed by selecting the tabs place top left. .

Both the Parameter and Log File View tabs are file viewers and will automatically be selected when their associated files are loaded. The Release Builder tab contains a utility for unpacking and putting a STS™ firmware release onto a memory stick.

A3. Starter View (continued)

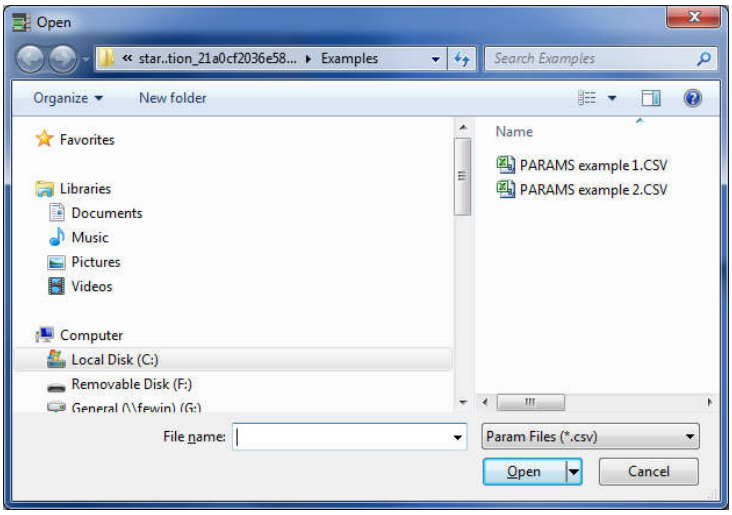
A3.4 Parameter Viewer and Editor



Parameter files are CSV (comma separated value) files containing a list of all parameter settings of the STS™ unit.

A3.4.1 Opening Parameter Files

Parameter files can be loaded into the viewer by either using the File/Open/Parameter menu or by drag and dropping a file onto the application.



File Open Dialogue

On the initial run of the viewer the default path will point to the installed folder with example parameter files. As a standard Windows open dialog you can navigate to any accessible folder to load other stored parameter files.

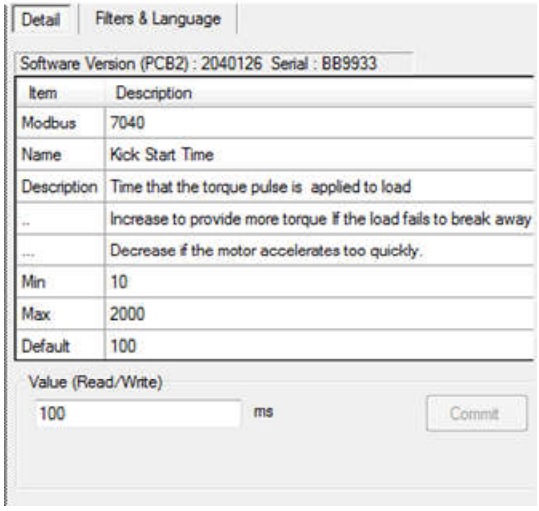
A3. Starter View (continued)

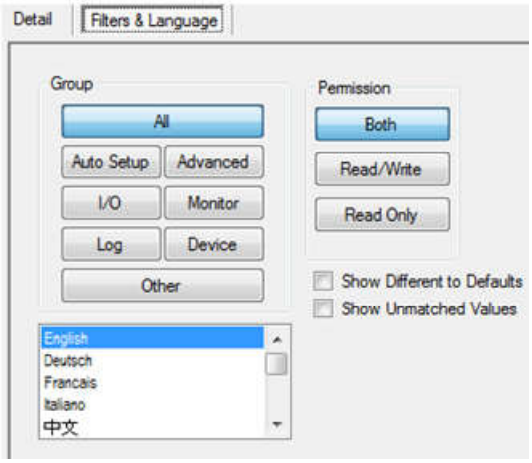
A3.4.2 Parameter View Layout

The viewer consists of two sizable panes:

The **left hand** pane contains the table view, consisting of 5 or 6 columns and a search entry box on the top and 4 output buttons on the bottom. When required scroll bars are present to help navigation through the data.

The **right hand** pane contains two tabs. The first showing the selected parameter details in a table. At the bottom of the tab, the parameter value is displayed. The parameter may be edited if writable.





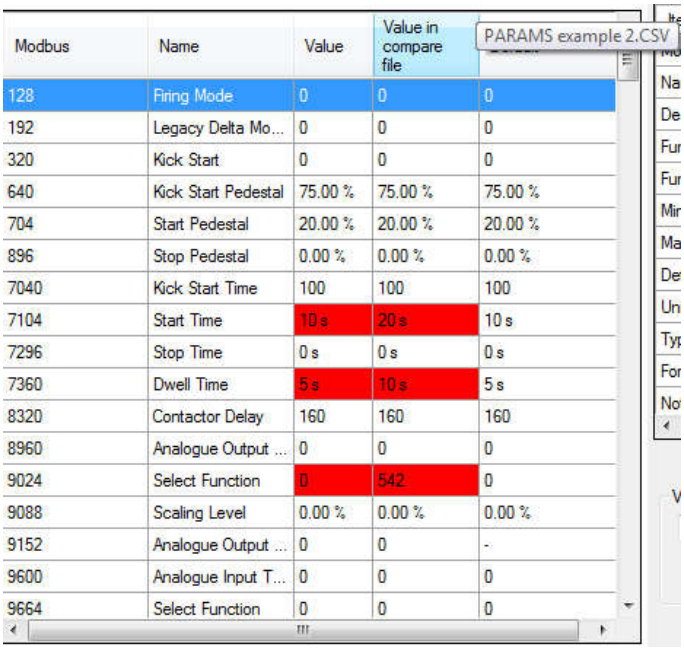
The other tab contains filters and language. The Group and Permissions button allows the user to refine what is displayed in the main table by category. The language selection will translate the parameter names in the table, if a translation is available

A3. Starter View (continued)

A3.4.3 Working with the Parameter View.

Table Values

One or Two files can be loaded into this viewer at one time. With one file loaded there will be 5 columns shown. The first column (headed Modbus) contains the Modbus address number for each parameter. For the advanced user, hovering over each of the Modbus cells will show the equivalent Profibus address and sub-index.



Modbus	Name	Value	Value in compare file	
128	Firing Mode	0	0	0
192	Legacy Delta Mo...	0	0	0
320	Kick Start	0	0	0
640	Kick Start Pedestal	75.00 %	75.00 %	75.00 %
704	Start Pedestal	20.00 %	20.00 %	20.00 %
896	Stop Pedestal	0.00 %	0.00 %	0.00 %
7040	Kick Start Time	100	100	100
7104	Start Time	10 s	20 s	10 s
7296	Stop Time	0 s	0 s	0 s
7360	Dwell Time	5 s	10 s	5 s
8320	Contactor Delay	160	160	160
8960	Analogue Output ...	0	0	0
9024	Select Function	0	542	0
9088	Scaling Level	0.00 %	0.00 %	0.00 %
9152	Analogue Output ...	0	0	-
9600	Analogue Input T...	0	0	0
9664	Select Function	0	0	0

The second column (headed Name) shows the “human” name for the parameter. Note that this is supplied using a translation table and allows for other languages selected from the Filters & Language tab.

The third column (headed Value) shows the values assigned to each parameter followed by the fourth column (head Default) containing the default values. If the value differs from the default the default cells background is coloured green to highlight the difference.

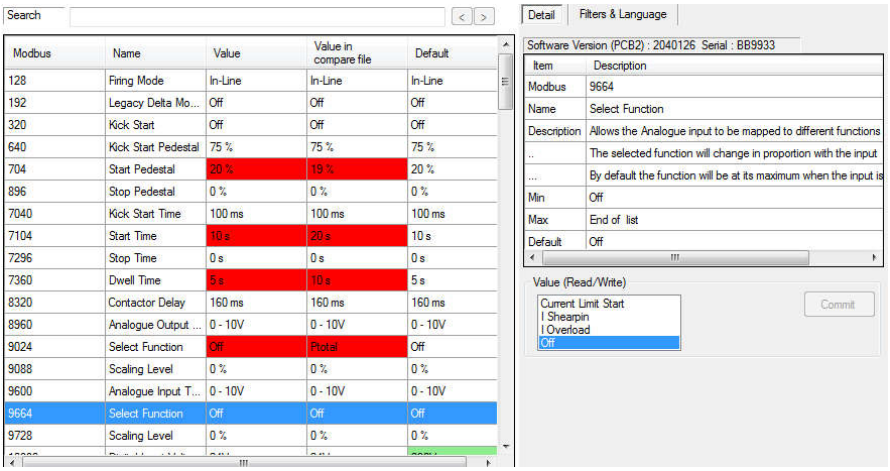
If two files are loaded together then an extra column (headed “Value in compare file”) is inserted between “Value” and “Default”. Where there are differences between a parameters of Value and “Value in compare file” the two cells will be coloured red to highlight the difference.

To file name that provides Value column data is shown on the StarterView top program header. The “Value in compare file” source path will be shown in a pop up box when the mouse marker is hovered over the column heading

A3. Starter View (continued)

Detail Tab

Selecting a parameter in the table view by clicking any cell in a row will cause the Detail tab, in the right pane, to fill with more details of that parameter. Moving through the table, by either clicking another cell or navigating with the up and down keyboard arrows, will cause the details to change. When selected, the table row becomes blue.



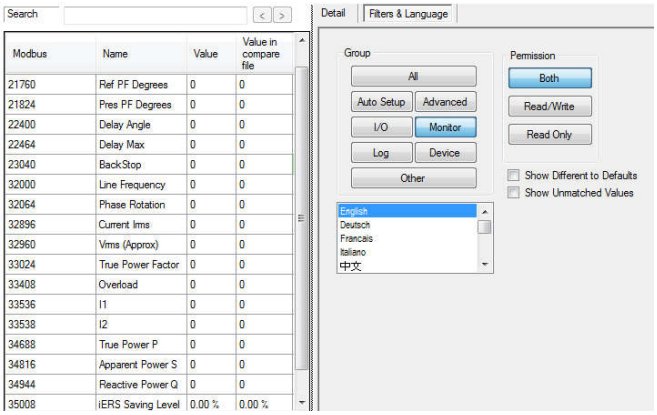
The detail is derived from the application database file. The Description gives an explanation of the parameter. Min, Max, Default and Units are all self-explanatory.

The Value panel, at the bottom of the Detail tab, shows the current value of the selected parameter and indicates whether it is Read only or Read/Write in nature. If it is Read/Write then the value can be edited.

The Filter and Language Tab

This tab has two functions. The first is to enable the "refining" of the displayed parameters in the table view by the selection of filters. The second is to select a language translation to the Name column of the table view.

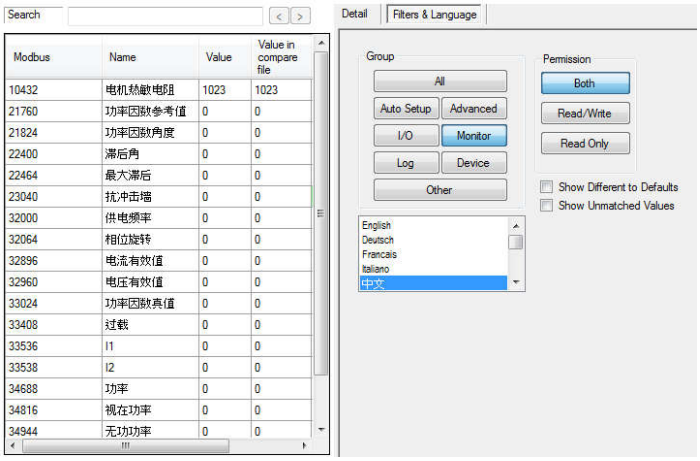
There are eight option buttons in the Group panel. The "All" button option is self-explanatory and is the default setting. The six central option buttons reflect the Home screen on the STS™ unit. When selected, the parameters columns shown will be those that are available in the sub menus and screens off of the STS™ button. The remaining "Other" button shows parameters that are not accessible beneath the STS™ Home screen.



The Permission button group allow hiding of Read/Write or Read-only parameters.
The remaining two check boxes allow the display of parameters that either do not agree with the default values and/or not match the values of another loaded file (when there are two loaded).

A3. Starter View (continued)

The language list selection of language translations of the Name values only. Note that only the parameters accessible in the STS™ front panel user interface will have translations, otherwise they will be rendered in English.



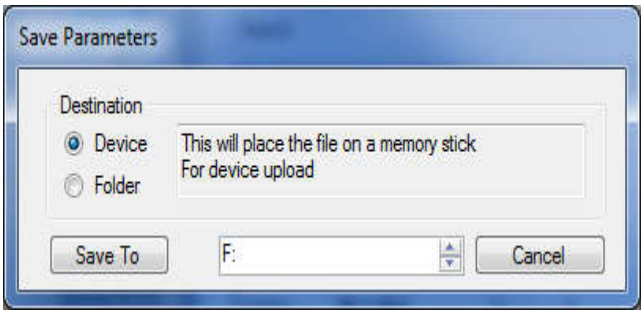
Search

Above the main table is a search box. As characters are typed in to the box, any parameter rows that contain a name field partly matching the characters, will be highlight. The highlight consists of the Modbus and Name field background being highlighted

Use the forward and back arrows on the right hand side of the entry box to navigate through the matched parameters if there is more than one.

A3. Starter View (continued)

Saving changes



A loaded parameter file can be saved using File/Save Parameters on the menu.
When save is selected a dialog appears given Destination options of Device or Folder. If Device is selected, the parameter file is to be copied on to a USB stick into the position that the STS™ expects to find it. This will only work if a memory stick is attached to the PC. When the "Save To" button is pressed the file will be copied to the stick into a hidden folder with the name PARAMS.CSV. This is the folder and file name required by the STS™ when the Device/Parameter From USB button is pressed.

If the Destination of "Folder" is selected then "Save" will save over the original loaded file. "Save As" will allow saving of anywhere with any name, within obvious network and Windows limitations. This would be used to archive working parameter sets.

Print, Email and PDFs

There are four buttons under the parameter table that allow output of the current table to a print preview, a printer, an email attachment or a PDF file. All these functions involve a re-rendering of the table into a PDF form. If the table is large then the time taken may be considerable. Print and Print Preview work in the same way as standard Windows applications. The email will create a PDF file that is attached to an email. There will be an automatic invocation to your email client, but this can only happen if it supports .eml files.

Obtaining parameter files from a STS™ unit.

Parameter files are produced from a STS™ unit as part of the log file download. See Section 3.14

Note: if the memory stick has a large number of files already on it the time taken to download maybe several minutes. In this case the STS™ screen may lock for a while, please do not power cycle the unit unless it has locked for longer than 5 minutes. It is therefore best to use an empty USB memory stick for this process.

Once file download completed, remove the stick and connect it to PCs USB socket. StarterView can access the parameter file directly or it can be copied to an archive location. Then use this as the StarterView parameter file location.

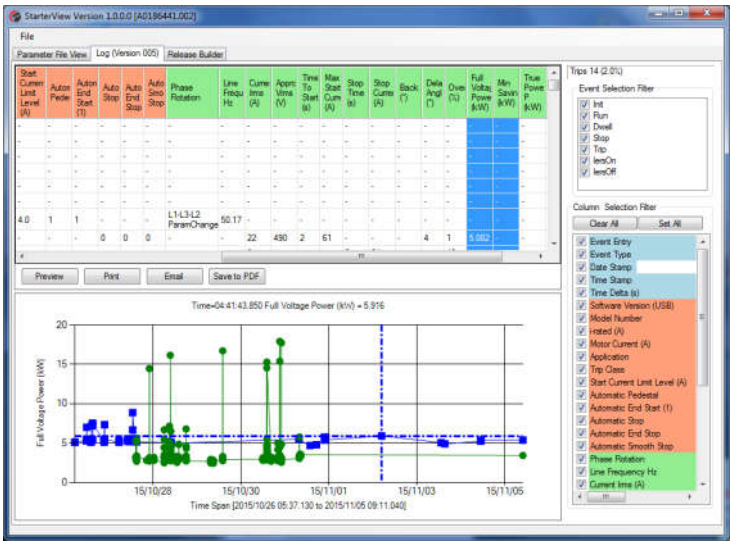
Redeploying the parameter file onto a STS™.

If you have edited the parameter file or you have preferred settings to copy onto one or more units, you need to save the file using the Save Parameter/Device option described in Saving changes. This will copy the file onto a hidden folder on the. See Section 3.14 for upload instructions.

A3. Starter View (continued)

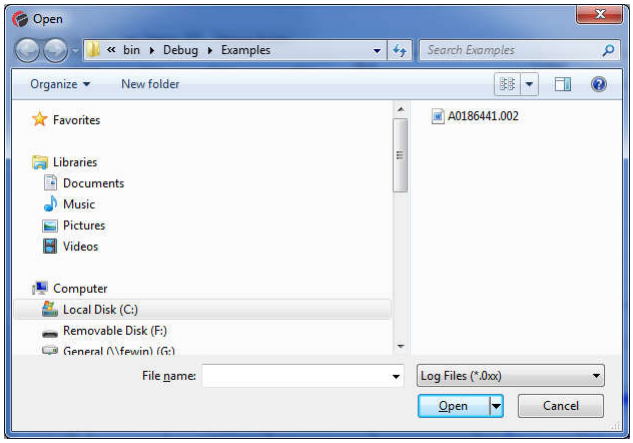
A3.5 Log File Viewer

A Log file contains a list of time tagged events that have occurred on a STS™ unit. Like Parameter, log files they are made up of comma delimited text that can be examined using a simple text editor or excel. But, like the parameter files, the complex detail of the data layout is such that it requires a decoder/viewer for the ordinary user in make sense of their content. The Log View does this, by intelligently decoding each event and then allowing the user to filter out events (rows) or event values (columns) that are not of interest, then showing events and event values that are of interest to that user.



Opening a log file

A log file can be loaded into the viewer by either using the File/Open/Log... menu or by drag and dropping a file onto the application.



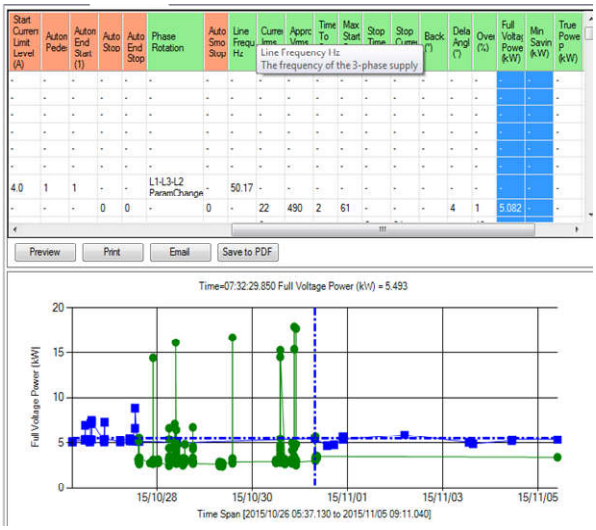
On the initial run of the viewer, the default path will point to the installed folder with an example log file. As a standard Windows open dialog you can navigate to any accessible folder to load other stored log files. Unlike the parameter viewer only one file can be loaded at a time.

A3. Starter View (continued)

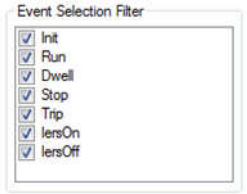
Log View Layout

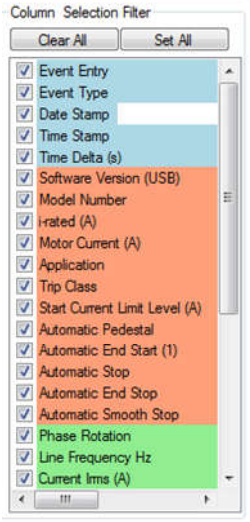
The viewer consists of two sizeable panes.

The Left hand pane contains the table view and optionally a graph. The table is made up of rows, each of which represents an event. Each event/row has a list of values/columns that may or may not show data. The graph can display the data of one or many selected columns



The right hand pane contains the event and column selection filters. The top event selector will show all of the events that are present in the load log file. Any that are not of interest can be deselected.
The column selection can be used to thin out the values that are not of interest also.





Working with the Log View

Table Values

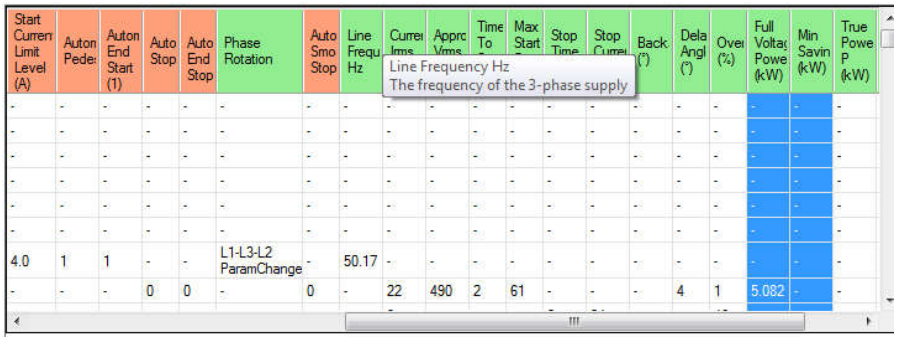
The table expands to show the log file loaded. Each row represents an event. By default the events are shown in date/time order. Each column represents a value type. Not all events share the same value types; therefore, many of the values may be blank showing a "-" in their cells. There are several values that all events share. These include Event Entry number, Event Type, Date and Time stamps and deltas. Some values can be shared by several, but not all, event types. The values/columns are headed with its name. A more detailed description of each column will be shown in a pop up tool-tip box when the mouse cursor hovers over the name heading.
Double-clicking a column header will cause the whole table to be sorted by the values in that column. This can take a long time with big tables.
It is possible to select parts of the table to copy to clipboard by clicking a starting cell and then dragging the pointer, with the mouse button depressed, to an end cell and then either doing the normal copy shortcut, control-c, or right clicking and selecting copy.

Columns can be re-arranged by "grabbing" the header and dragging the column to where required in the table. Column widths can also be manually sized if required.

Hovering over the column headers will cause a more detailed description of the value type to be shown in a pop-up.

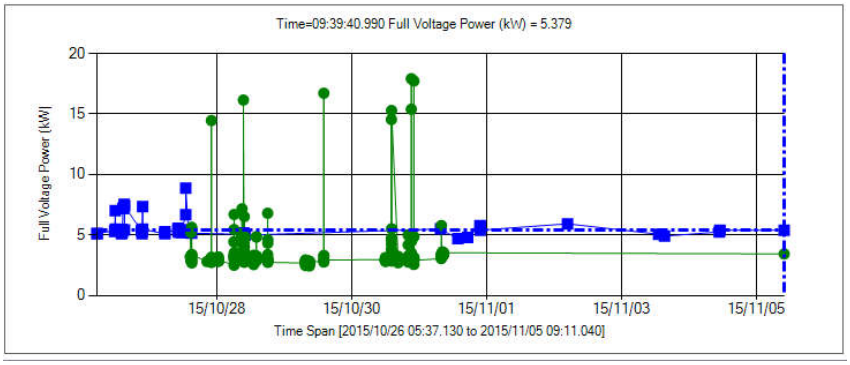
A3. Starter View (continued)

In this example Phase Rotation has been moved from its default position, and the Line Frequency Column hover pop-up is showing more detail.



Graph Creation and Use

To create a line graph, select the required columns (clicking the required columns header(s)) followed by a right click. From the pop-up select "Graph selected columns" and a graph will be created in a pane below the table containing a line trace for every column selected and having a date/time X-Axis. Note that if any parts of a table column are selected then the whole column will be shown in the graph. Also columns selected that do not contain numeric values will not be graphed.



Once the graph is rendered it is possible to navigate through the data using the cross hairs placed over the currently active line data. To help discriminate data sets, when more than one is loaded, each will have a different colour and the cross hairs will have the same colour as the active set. The name of the active set will appear on the Y-Axis. The current selected data point is indicated by the cross hairs placement and the coordinate value shown at the top. As the mouse cursor is moved over the graph (when the chart control is in focus) the cross hairs will snap onto the closest data coordinate to the mouse cursor, changing the top values when this happens.

If there is more than one data set selected the cursor can be made to cycle through each one by right clicking and selecting "Switch Data Series".

To zoom in and out of the graph use either the mouse wheel or the keyboard arrow keys. First give the graph focus by clicking it and selecting the data point that needs to remain central. The rotate the mouse wheel upward to zoom in the X-Axis, rotate downward to zoom out. For the Y axis use the mouse wheel with either the left mouse button presses or the control key pressed simultaneously. The same thing can be achieved by pressing the control key and using the up, down, left and right arrows on the keyboard. Up and down for Y-Axis zoom in and out. Right and Left for X-Axis zoom in and out. To zoom right out again right click the graph and select "Zoom Out Show All" from the pop-up.

To position into the same table event row as the current cross hair position, right click and select "Show Point in Grid".

A3. Starter View (continued)

Event Selection Filter

Each row represents an event. When a log file is loaded the event types are counted as the table is populated and those that are present are added to the Event Selection Filter panel. By default these will all be checked so that all of the rows are shown in the table.
If the file only has trip events, for example, the Trip selection will only be shown. Deselection of any of the events in the box will hide those rows. If all are unchecked then no data will be shown in the table. Note, this does not affect the graph view.

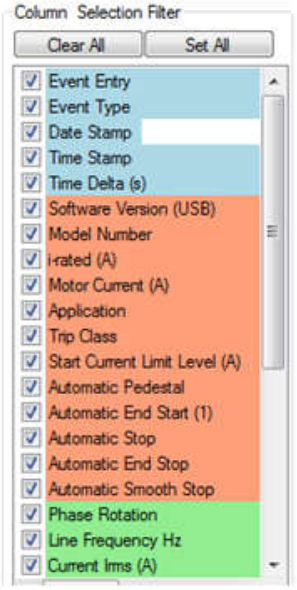
Column Selection Filter

Each column represents a value type.
The Column Selection Filters check list shows the values types that can picked. Unchecking any of the events shown will hide those columns in the table.

Tip. Hovering over a checked column value of interest will highlight that column on the table.

The coloured sections show three groups. These are reflected on the table headings.

The Blue group are event tags. Red are settings or fixed information. Green members show dynamic values that will change over operational time.



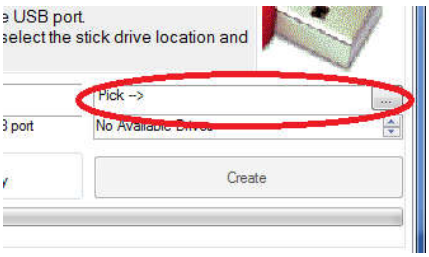
Print, Email and PDFs

Just like the parameter view there are four buttons under the table that allow output of the current table to a print preview, a printer, an email attachment or a PDF file. All these functions involve a re-rendering of the table into a PDF form and graph, if visible, into a jpg file. If the table is large then the time taken can also be large. Other than this the Print and Print Preview work in the same way as any normal Windows application. The email will create a PDF file that is attached to an email. There will be an automatic invocation to your email client, but this can only happen if it supports .eml files. Most clients do. The generated email will have attached the source parameter file(s) as well as the generated table PDF and option graph jpg file.

A3.6 Firmware Upgrade Utility (Release Builder)

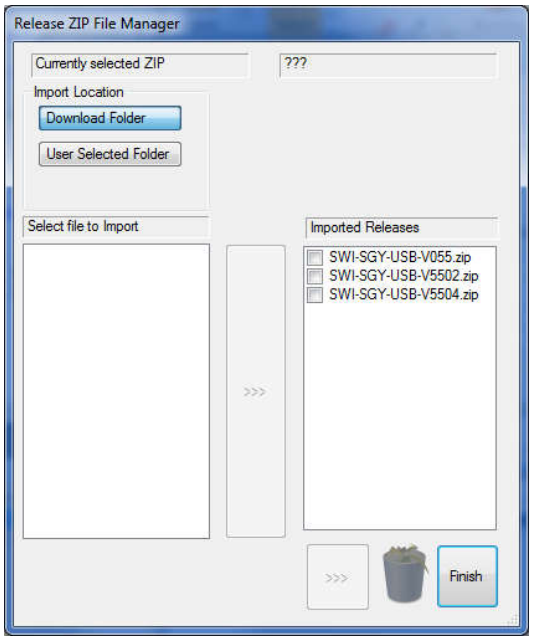
The purpose of the Release Builder is to create a memory stick containing the required firmware release from a supplied zip package file. Once the stick has been prepared, a graphical guide can be used to ensure that the upgrade operation is performed properly.

When StarterView is first installed there will be no ZIP file selected. This is indicated by the “STS™ Version to Create” field showing “Pick ->” pointing to the button. Press this to start the Release ZIP File Manager dialog

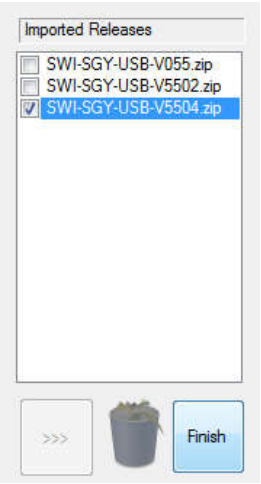


A3. Starter View (continued)

A3.6 Firmware Upgrade Utility (continued)

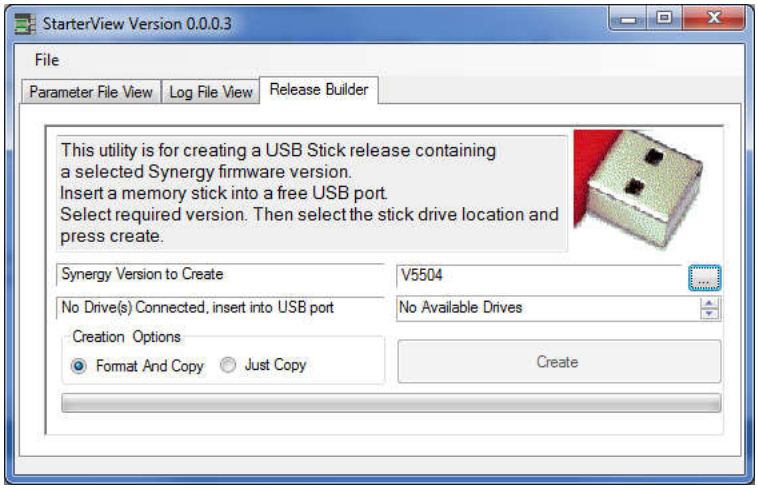


The Release ZIP Manager allows the importation of firmware release packages into a library. When StarterView is installed that library will be empty. It is required to select and import packages obtained from Fairford. If downloaded, the upgrade zip file will normally be placed in your download folder. The default import location will be that selected by the "Download Folder" button. If you import from another location select "User Selected Folder" and use the folder selector to locate the source folder. Then select the required zip file and press the centre import button to transfer into the library.



The dialog will show the current releases installed in the StarterView library. From the list, select the version you want to install by checking the required ZIP file and then press finish.

The Release Builder tab will now show the version that was selected. This will be remembered for subsequent runs of the Builder.



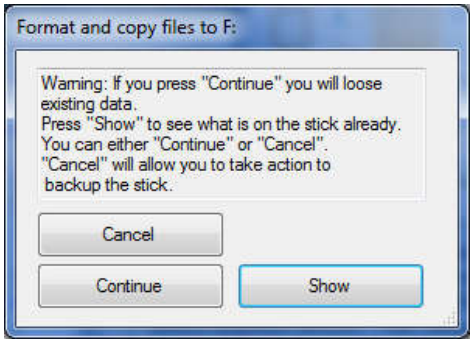
To continue, at least one memory stick needs to be connected to a USB port. If none are connected then "No Available Drives" will be shown. When one or more sticks are connected, the selector, on the right hand side, will become populated with the drive letters assigned to it or them. If only one is inserted then that will be used for the creation destination, otherwise the required stick must be selected from the list.

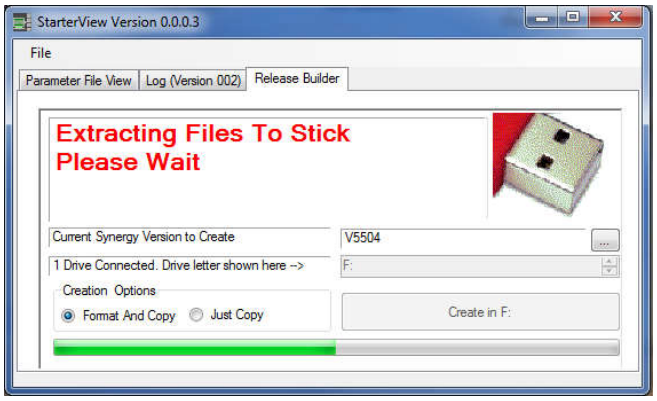
When selected, the drive letter will also appear on the Create button to confirm the correct drive required.
Before initiating the creation process the "Creation Options" can be changed from "Format and Copy" to "Just Copy". Choosing "Just Copy" will avoid loss of other files you have on the stick, apart from those that have the same name as the files to be copied. Using "Format and Copy" will ensure that the stick is in the correct format to be recognised by the STS™ unit.

A3. Starter View (continued)

A3.6 Firmware Upgrade Utility (continued)

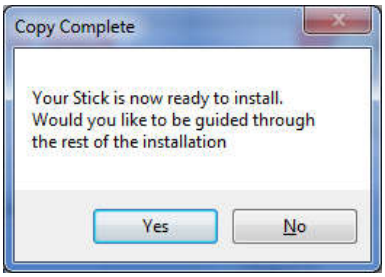
When ready press “Continue” to return to the “Release Builder” tab and a progress bar will track the copy. This will take time, dependent on the hardware speeds. There is no way to cancel this process once it has started (removing the stick during the process will corrupt data and could damage the stick)





When the creation has finished it will show this prompt.

Select ”Yes” in the next dialogue screen, to start a graphical guide for the firmware upgrade process.



A4. Updating synergy™ Firmware

Appendix 4

A4.1 Introduction

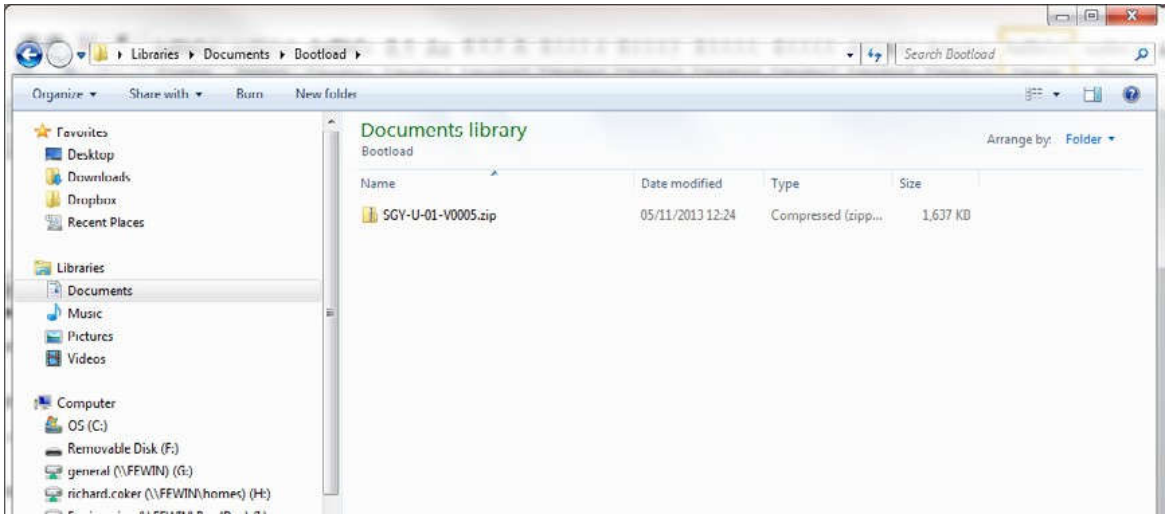
In the event that the STS™ unit requires a firmware update, this can be achieved on an installed unit without the need for any additional equipment other than a USB memory stick.

A.4.2 Instruction for Updating

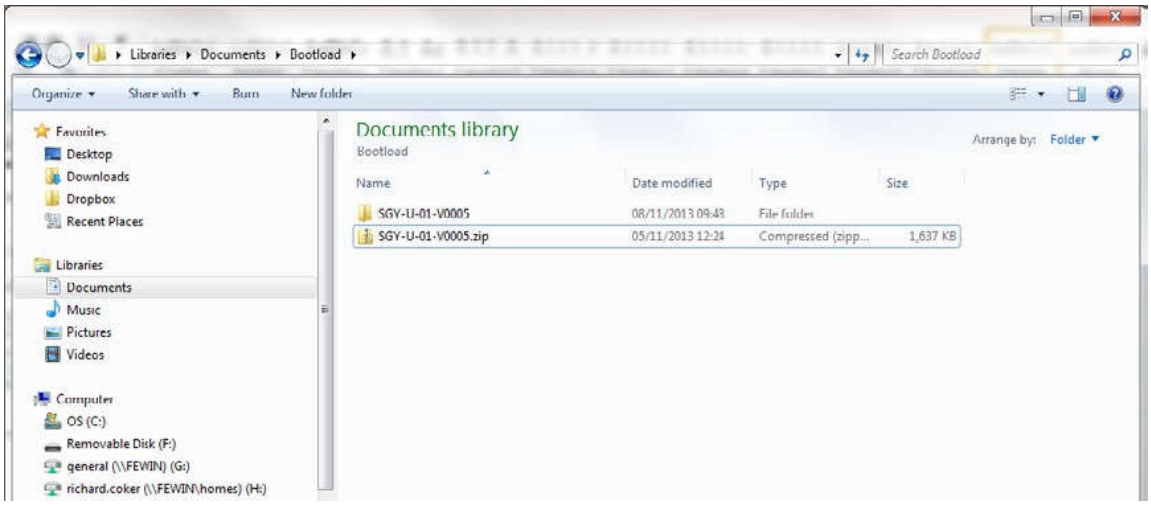
- Obtain a USB flash drive, and ensure that it has been formatted to FAT32.
  Part number USB-KEY is a USB flash drive that has been verified to work with STS™. Other flash drives may not physically fit, or may not perform correctly. Available to purchase from SIT Automation.

- Obtain a new firmware from SIT Automationj

- Copy the zip file into a suitable location on your PC that you can extract all of the firmware files

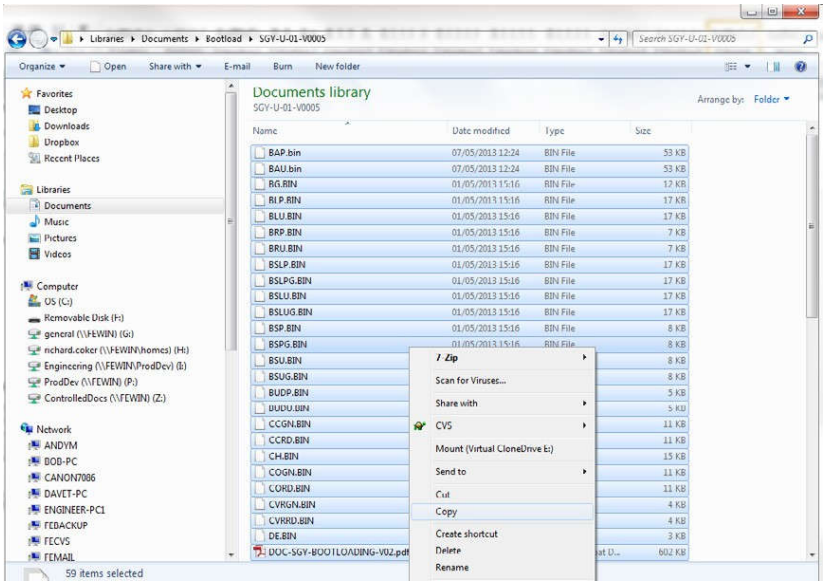


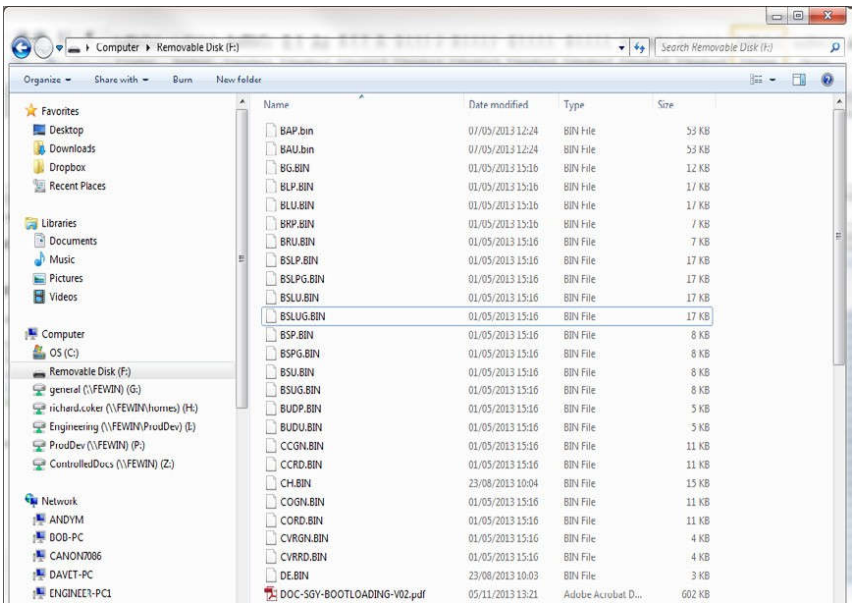
- Right click on the zip file and select extract all. This will create an unzipped directory in the same location with the same name.



A4. Updating synergy™ Firmware (continued)

Double click on the new directory to display the unit update files. Select all files and copy them to the root directory of the USB flash drive.

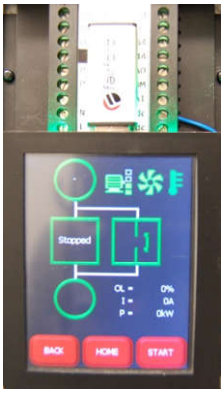




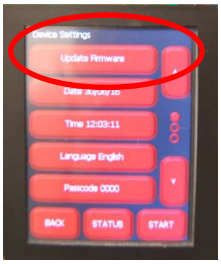
A4. Updating synergy™ Firmware (continued)

USB Flash Drive

Insert the USB flash drive into the USB connector on the synergy™ unit

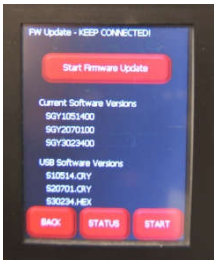


Use the touchscreen to navigate to the Update Firmware selection button.
Home >> Device >> Update Firmware



The next screen shows the 'current' installed firmware version and the firmware version previously copied to the USB flash drive.

Depress the Start Firmware Update button.



Confirm the firmware update by pressing YES.

Ensure the synergy™ unit remains powered during the update process.

Once the firmware files are transferred to the synergy™ unit, the update process will commence. The update process is a three step process indicated on the touchscreen.

Once the update is complete, synergy™ will reboot and display the status screen.

A5. User Serviceable Items

Appendix 5

A5.1 Fan Replacement

A5.1.1 Replacement Fan Part Numbers

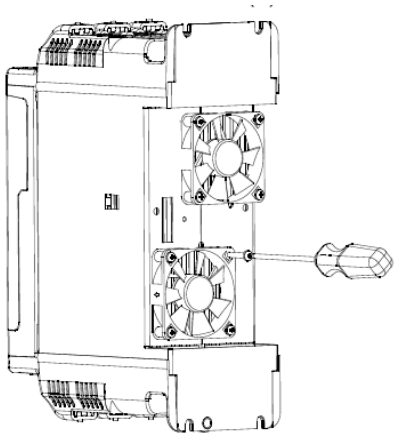
It is recommended that replacement fans are replaced with original specification fans available from the manufacturer. Alternatives may have inferior performance leading to potential overheating and damage to the STS™ unit.
Part numbers for the replacement fans are detailed in the table below:

STS™ Replacement Fans		
Part Number	*Description*	*For STS- Models*
FAN-002[1]	Cooling fan, replacement, for STS™ series soft starters, 60 x 60 x 15 mm	101 thru 117
FAN-003[1]	Cooling fan, replacement, for STS™ series soft starters, 80 x 80 x 15 mm	201-203
FAN-014[1]	Cooling fan, replacement, for STS™ series soft starters, 80 x 80 x 20 mm	205
FAN-007[1] [2]	Cooling fan, replacement, for STS™ series soft starters, 120 x 120 x 25 mm	301 thru 305
FAN-008 (110V)	Cooling fan, replacement, for STS™ series soft starters, 171 x 151 x 151 mm	307 thru -309
FAN-009 (230V)	Cooling fan, replacement, for STS™ series soft starters, 171 x 151 x 151 mm	307 thru -309

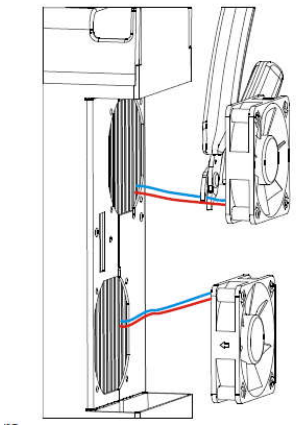
[1]All fans (except FAN-008 and FAN-009) require 4 butt-splice terminals. Part number MIS-017
[2]FAN-007 also require 4 push rivets. Part number MISC652.

A5.1.2 Fan Replacement Procedure – STS-101 thru STS-305

1) Unscrew existing fans



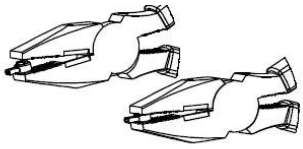
2) Cut wire as close as possible to fan/s



A5. User Serviceable Items (continued)

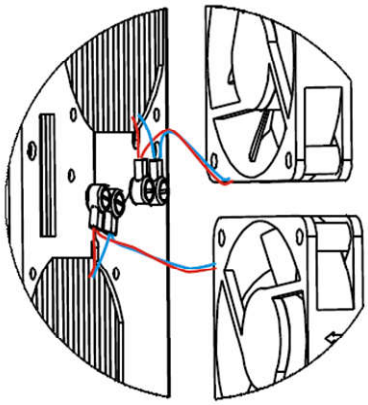
fit blue wires from new fan
and Synergy into connector

squeeze with pliers

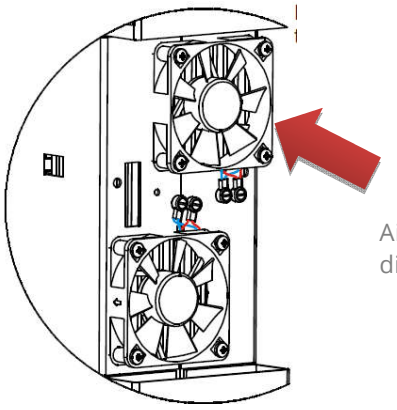


Repeat with second pair of blue.
Then 2 pairs of red wires

position fans and connectors



Fix new fan(s) to unit



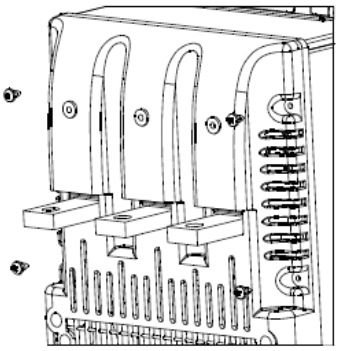
Air flow
direction

STS-301 to STS-305 have metal fan guards fitted for safety reasons.
These must be removed before the fans can be taken off. They MUST be refitted using the supplied push rivets after the fans have been attached.

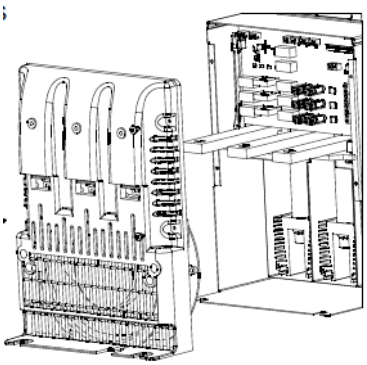
A5. User Serviceable Items (continued)

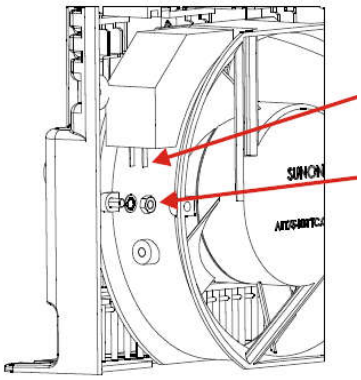
A5.1.3 Fan Replacement Procedure – STS-307 and STS-309

Remove 4 screws on lower end moulding



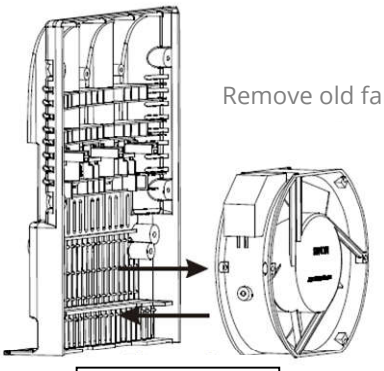
Slide lower end moulding off busbars





Pull wires off connectors

Fan held with M4 screws in 2 positions



Remove old fan

Reassemble in reverse order
Orientation of wires is not critical

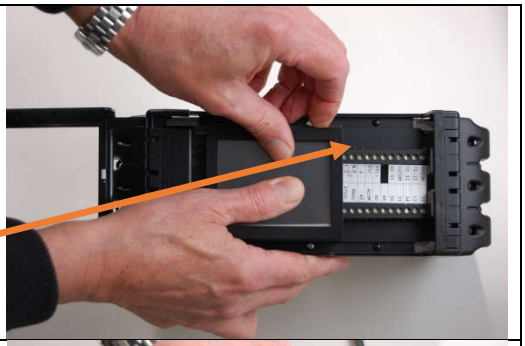
Air flow direction

Fit new fan

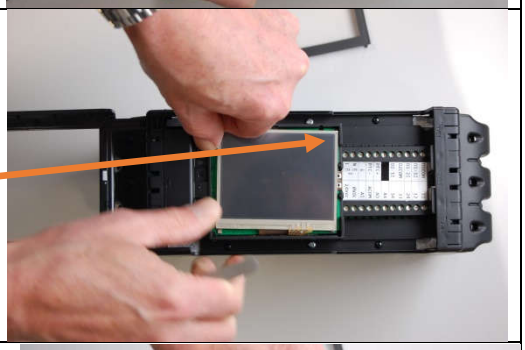
A5. User Serviceable Items (continued)

A5.1.4 LCD Touchscreen Replacement

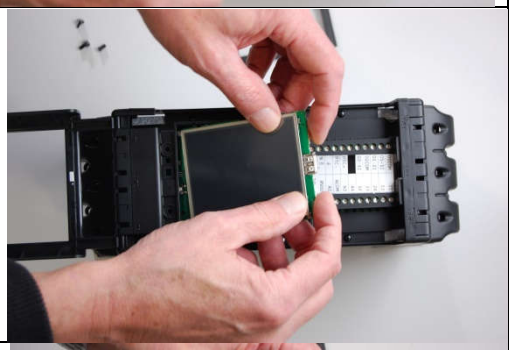
1.
Carefully remove the outer bevel casing around the LCD display.



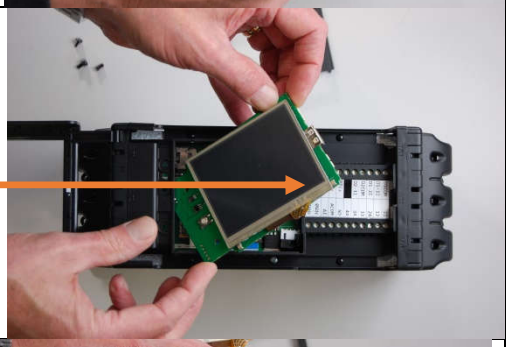
2.
Remove the two plastic rivets below the LCD display. Use a small screwdriver to lever the rivets out.



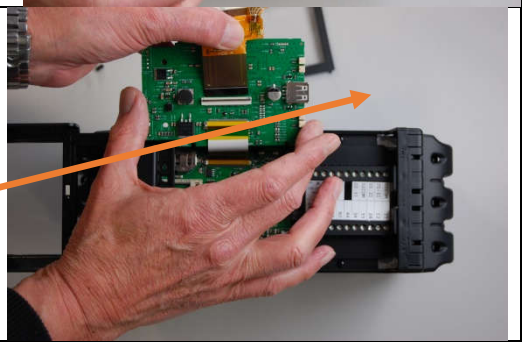
3.
When removing the LCD display and PCB, Slowly Lift from the top left corner.



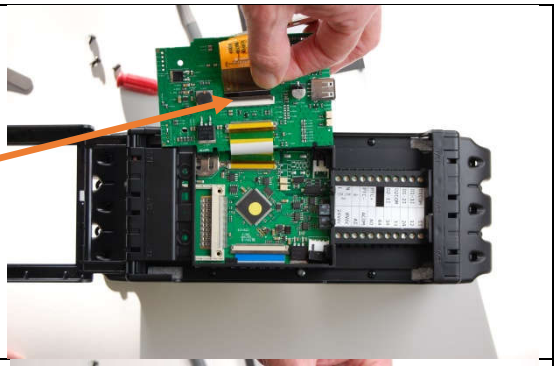
4.
Gently remove the LCD and PCB at an angle, so they can be lifted from the unit. Take care not to apply excessive force.



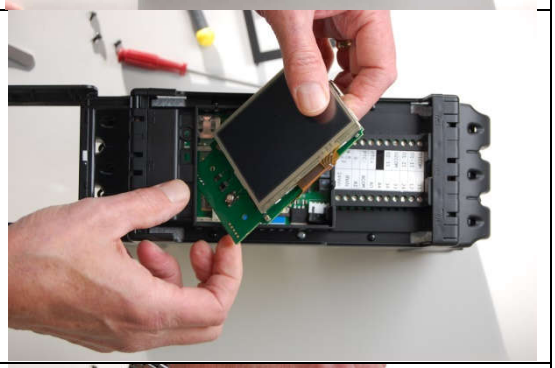
5.
On the reverse side of the PCB remove the FFC cable From the socket (lift grey part from front edge, do not force.)



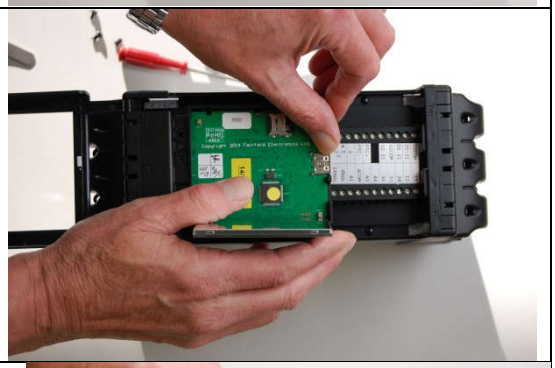
6.
Place the replacement screen FFC cable in socket. Making sure it is correctly seated. Push the grey part down to lock.



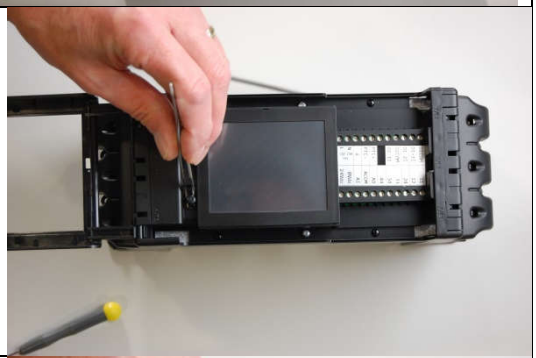
7.
Once the socket is locked with the FFC cable firmly connected, gently place the board back in to the previous position, using the same angled technique.



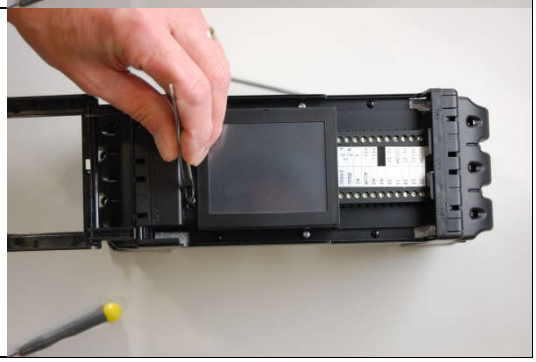
8.
Place pcb flat in position.



9.
Make sure the screen is correctly aligned and outer bevel is placed back on the LCD display.



10.
Once you have placed the outer bevel back on LCD display. Ensure that the two plastic rivets below the LCD display are re-installed.



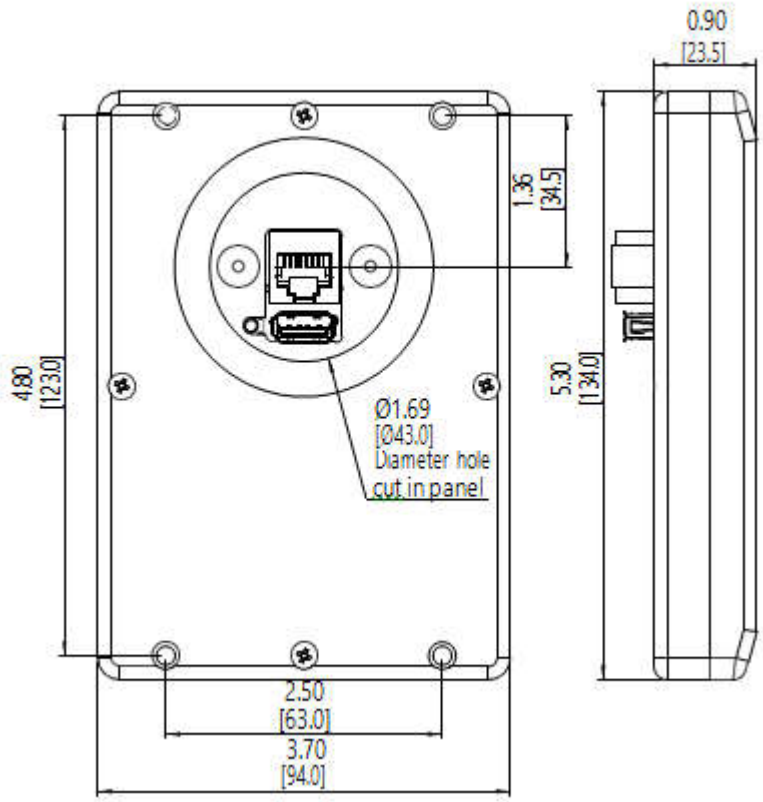
A6. Remote Keypod Setup – STS-010

Appendix 6

A6.1 Introduction

The remote keypod (STS-101) can be used to control, monitor and program up to 32 STS™ soft starters.

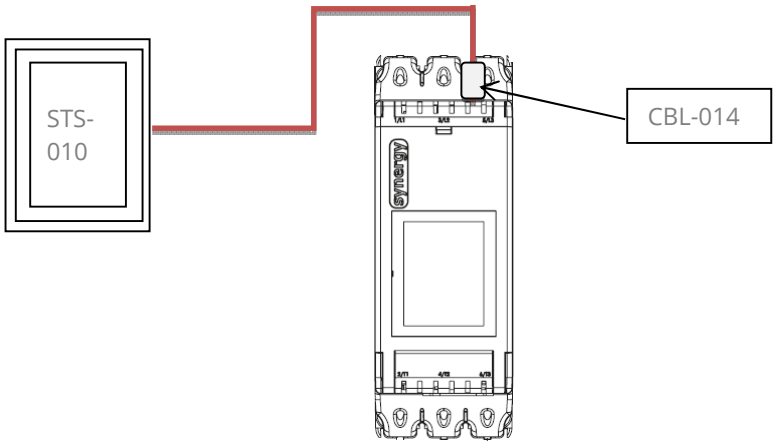
The remote unit is powered from the host STS™ and requires only an Ethernet cable for communication. Please see Section 4.1



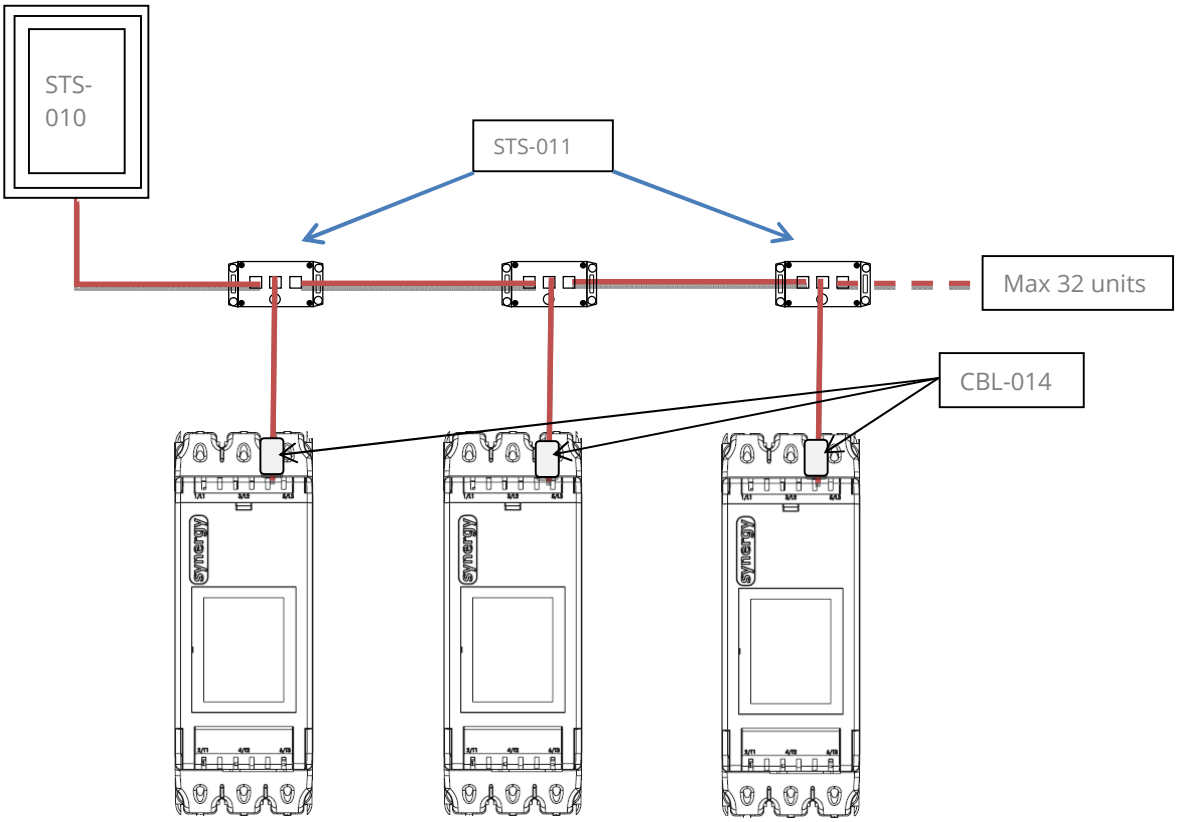
A6.2 Network Connection

For a configuration where there is only one STS™ unit (one-to-one) the remote and main unit can be directly cabled. See Diagram overleaf:

A6. Remote Keypad Setup (continued)



For multiple base units connected to the keypod, the use of STS-011 is highly recommended. See diagram below.



A6 Remote Keypod Setup (continued)

A6.3 Remote Keypod Operation

Ensure starter's Modbus Network Settings are: Even parity and 19200 baud rate. If connecting to multiple starters, set the Address to a unique number for each STS™ starter.

If remote touchscreen start/stop control is desired, set the Control Method to Modbus Control. If the remote touchscreen will only be used for monitoring or configuration (digital input or local touchscreen start/stop control will be used), select the appropriate setting (Local Touchscreen, User Programmable, 2-wire control, or 3-wire control).

Connect remote touchscreen using the CBL-014 adapter (STS™ end) and a standard Ethernet patch cable. If connecting to multiple starters, a Modbus splitter (STS-011) will be required for each starter.

On the remote touchscreen go to Modbus Network Settings as shown in Fig 1. and select Scan Bus. This will show all the STS™ starters on the bus (Fig 2). Select which starter you wish to connect to.
Alternatively you can select the Address number and then select Connect to connect to that particular starter.

The status screen Fig 3 on the remote touchscreen will display the current starter it is connected to by displaying the starter's node address and serial number (Example: address 01 and serial number A0167805)

Figure 1

Figure 2

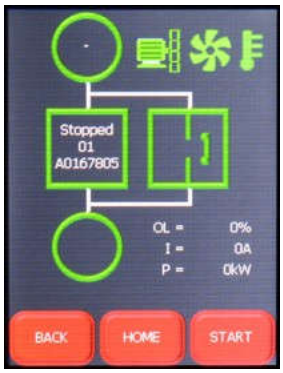


Figure 3

The remote touchscreen's control for starting and stopping overrides the starter's onboard touchscreen when the starter's Control Method is set to Modbus Control. Menu navigation, configuration, and monitoring are still possible on the starter's touchscreen.

Press the starter icon box on the Status screen of the remote touchscreen to change to another starter if controlling multiple starters from one remote touchscreen.

When using the remote touchscreen for start/stop control the remote touchscreen has full control, configuration, and monitoring capabilities, while the local touchscreen on the starter only has configuration and monitoring capabilities. Digital outputs always function as programmed, regardless of Control Mode. Digital inputs are disabled during Modbus Control and Keypad Control Modes, but are active during all other Control Modes.

The remote touchscreen can be used for monitoring and configuration during any other control method besides Modbus Control.

A6 Remote Keypod Setup (continued)

The remote keypod can only be used with the standard ‘on-board’ Modbus RTU connection. It can not be used with Anybus modules.

The remote touchscreen is a Modbus RTU master device. A PLC, HMI, or other Modbus Master device cannot be used on the same network while the remote touchscreen is connected.

Notes

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