



# Modbus Module

## User Manual

### 1 Important User Information

Observe all necessary safety precautions when controlling the soft starter remotely. Alert personnel that machinery may start without warning.

It is the installer's responsibility to follow all instructions in this manual and to follow correct electrical practice.

Use all internationally recognised standard practice for RS-485 communications when installing and using this equipment.

### 2 Installation

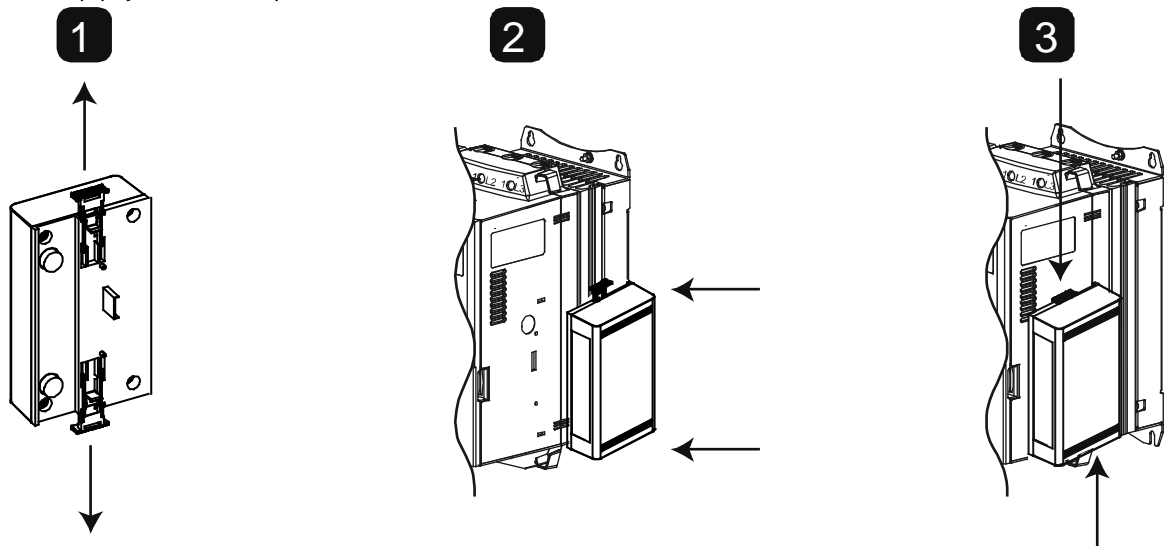


#### CAUTION

Remove mains and control voltage from the soft starter before attaching or removing accessories. Failure to do so may damage the equipment.

#### 2.1 Installation Procedure

1. Remove control power and mains supply from the soft starter.
2. Fully pull out the top and bottom retaining clips on the module.
3. Line up the module with the comms port slot.
4. Push in the top and bottom retaining clips to secure the module to the starter.
5. Apply control power to the soft starter.

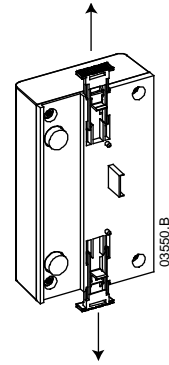


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Remove the module using the following procedure:

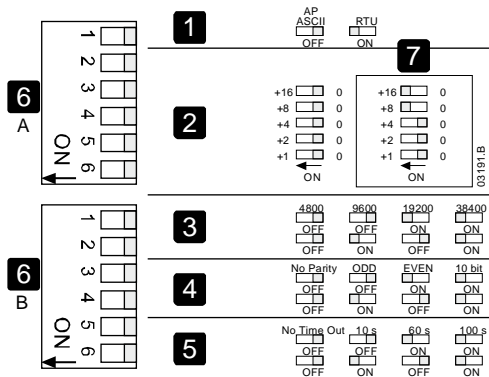
1. Take the module off-line.
2. Remove control power and mains supply from the soft starter.
3. Disconnect all external wiring from the module.
4. Fully pull out the top and bottom retaining clips on the module.
5. Pull the module away from the soft starter.



### 3 Configuration

#### 3.1 Adjustment

Network communication parameters must be set on the Modbus Module. DIP switch settings take effect on the power-up of the Modbus Module via the soft starter.



<b>1</b>	Protocol
<b>2</b>	Address
<b>3</b>	Baud rate
<b>4</b>	Parity
<b>5</b>	Timeout (seconds)
<b>6</b>	DIP switch
<b>7</b>	Example: Address = 24

#### 3.2 Master Configuration

For standard Modbus 11-bit transmission, the Master must be configured for 2 stop bits with No Parity and 1 stop bit for odd or even parity.

For 10-bit transmission, the Master must be configured for 1 stop bit.

In all cases, the Master baud rate and slave address must match those set on the Modbus Module DIP switches.

The data polling interval must be long enough for the module to respond.

Short polling intervals may cause inconsistent or incorrect behaviour, particularly when reading multiple registers. The recommended minimum polling interval is 300 ms.



## 4 Connection

ASTAT XB/XBm: For the Modbus Module to accept fieldbus commands, a link must be fitted across terminals A1-02 on the soft starter.

ASTAT XL: Input links are required across the stop and reset inputs if the soft starter is being operated in Remote mode. In Local mode, links are not required.



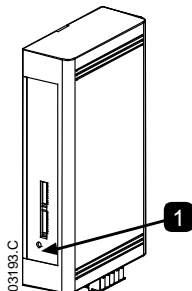
### NOTE

ASTAT XL: Parameter *Comms in Remote* selects whether the soft starter will accept Start and Stop commands from the Serial Network Master while in Remote Mode. See the soft starter user manual for parameter details.

ASTAT XB/XBm		ASTAT XL	
<b>1</b>	ASTAT XB/XBm A1, 02: Stop input	<b>1</b>	ASTAT XL (Auto mode) 56, 57: Stop input 58, 57: Reset input
<b>2</b>	Modbus Module – RS-485 serial port	<b>2</b>	Modbus Module – RS-485 serial port
<b>3</b>	RS-485 connection onto Modbus network	<b>3</b>	RS-485 connection onto Modbus network

## 5 LEDs

The Network Status LED (1) indicates the state of the communications link between the module and the network. LED operation is as follows:



<b>1</b>	Off	No connection or soft starter not powered up
	On	Communication active
	Flashing	Communication inactive



### NOTE

If communication is inactive, the soft starter may trip if the Communications Timeout function has been set on the module. When communication is restored, the soft starter will require a Reset.



## 6 Modbus Functions

The Modbus Module supports the following Modbus functions:

- 03 Read multiple registers
- 06 Write single register
- 16 Write multiple registers

Modbus broadcast functions are not supported.

ASTAT XB/XBm soft starters (including Remote Operator):

- Read multiple registers 40003 to 40008
- Write single register 40002

ASTAT XL soft starters:

- Read multiple registers starting from 40003 up to a maximum of 119 register blocks.
- Single write register 40002 or multiple write registers 40009 to 40599.



### NOTE

A multiple read across register boundary 40008/40009 will result in a Modbus Error code 05 at the Master.

## 7 Modbus Register



### NOTE

Some soft starters do not support some functions.

Registers 40600 and above are not compatible with ASTAT XB/XBm Series soft starters. For ASTAT XB/XBm, use registers 40002~40008. ASTAT XB open loop soft starters will read back average current as "2222" and motor 1 temperature as "111" decimal.

Register	Description	Bits	Details
40002	Command (single write)	0 to 2	To send a command to the starter, write the required value: 1 = Start 2 = Stop 3 = Reset 4 = Quick stop (coast to stop) 5 = Forced communication trip 6 = Start using Parameter Set 1 <sup>1</sup> 7 = Start using Parameter Set 2 <sup>1</sup>
		3 to 7	<i>Reserved</i>



Register	Description	Bits	Details
40003	Starter state	0 to 3	1 = Ready 2 = Starting 3 = Running 4 = Stopping (including braking) 5 = Restart delay (including temperature check) 6 = Tripped 7 = Programming mode 8 = Jog forward 9 = Jog reverse
		4	1 = Positive phase sequence (only valid if bit 6 = 1)
		5	1 = Current exceeds FLC
		6	0 = Unintialised 1 = Initialised
		7	0 = Remote Operator communications are OK 1 = Remote Operator/Communications device fault
40004	Trip code	0 to 7	See <i>Trip Codes</i> on page 8
40005 <sup>2</sup>	Motor current	0 to 7	Average 3-phase motor current (A)
40006	Motor temperature	0 to 7	Motor 1 temperature (thermal model)
40007	Product information	0 to 2	Product parameter list version
		3 to 7	Product type code <sup>3</sup>
40008	Serial Protocol Version	0 to 7	Communication protocol between module and starter
40009 <sup>4</sup>	Parameter management Single or multiple read or write	0 to 7	Manage soft starter programmable parameters.
40600	Version	0 to 5	Binary protocol version number
		6 to 8	Parameter list version number
		9 to 15	Product type code <sup>3</sup>
40601	<i>Reserved</i>		
40602 <sup>5</sup>	Changed parameter number	0 to 7	0 = No parameters have changed 1~255 = Index number of the last parameter changed
		8 to 15	Total number of parameters available in the starter



Register	Description	Bits	Details
40603 <sup>5</sup>	Changed parameter value	0 to 13	Value of the last parameter that was changed, as indicated in register 40602
		14 to 15	<i>Reserved</i>
40604	Starter state	0 to 4	0 = <i>Reserved</i> 1 = Ready 2 = Starting 3 = Running 4 = Stopping 5 = Not ready (restart delay, restart temperature check) 6 = Tripped 7 = Programming mode 8 = Jog forward 9 = Jog reverse
		5	1 = Warning
		6	0 = Unintialised 1 = Initialised
		7	0 = Local control 1 = Remote control
		8	0 = Parameter(s) have changed since last parameter read 1 = No parameters have changed <sup>5</sup>
		9	0 = Negative phase sequence 1 = Positive phase sequence
		10 to 15	See <i>Trip Codes</i> on page 8 <sup>6</sup>
40605 <sup>2</sup>	Current	0 to 13	Average rms current across all three phases
		14 to 15	<i>Reserved</i>
40606	Current	0 to 9	Current (% motor FLC)
		10 to 15	<i>Reserved</i>
40607	Motor temperature	0 to 7	Motor 1 thermal model (%)
		8 to 15	Motor 2 thermal model (%)
40608 <sup>7</sup>	Power	0 to 11	Power
		12 to 13	Power scale
		14 to 15	<i>Reserved</i>
40609	% Power factor	0 to 7	100% = power factor of 1
		8 to 15	<i>Reserved</i>
40610	<i>Reserved</i>		



Register	Description	Bits	Details
40611 <sup>2</sup>	Current	0 to 13	Phase 1 current (rms)
		14 to 15	<i>Reserved</i>
40612 <sup>2</sup>	Current	0 to 13	Phase 2 current (rms)
		14 to 15	<i>Reserved</i>
40613 <sup>2</sup>	Current	0 to 13	Phase 3 current (rms)
		14 to 15	<i>Reserved</i>
40614	<i>Reserved</i>		
40615	<i>Reserved</i>		
40616	<i>Reserved</i>		
40617	Parameter list version	0 to 7	Parameter list minor revision
		8 to 15	Parameter list major version
40618	Digital Input state	0 to 15	For all inputs, 0 = open, 1 = closed (shorted) 0 = Start 1 = Stop 2 = Reset 3 = Input A 4 to 15 = <i>Reserved</i>
40619~ 40631	<i>Reserved</i>		

<sup>1</sup> Ensure that the programmable input is not set to Motor Set Select before using this function.

<sup>2</sup> For models QLxxB0053D and smaller this value will be 10 times greater than the value displayed on the keypad.

<sup>3</sup> Product type code:

4 = ASTAT XB/XBm

9 = ASTAT XL

<sup>4</sup> See the relevant soft starter literature for a complete parameter list. The first product parameter is always allocated to register 40009. The last product parameter is allocated to register 40XXX, where XXX = 008 plus total number of available parameters in the product.

<sup>5</sup> Reading register 40603 (Changed parameter value) will reset registers 40602 (Changed parameter number) and 40604 (Parameters have changed). Always read registers 40602 and 40604 before reading register 40603.

<sup>6</sup> Bits 10~15 of register 40604 report the soft starter's trip or warning code. If the value of bits 0~4 is 6, the soft starter has tripped. If bit 5 = 1, a warning has activated and the starter is continuing to operate.



<sup>7</sup> Powerscale functions as follows:

0 = multiply Power by 10 to get W

1 = multiply Power by 100 to get W

2 = Power is represented in kW

3 = multiply Power by 10 to get kW

## 8 Trip Codes

Trip Code	Description	ASTAT XB	ASTAT XBm	ASTAT XL
1	Excess start time		●	●
2	Motor overload		●	●
3	Motor thermistor		●	●
4	Current imbalance		●	●
5	Frequency	●	●	●
6	Phase sequence		●	●
7	Instantaneous overcurrent			●
8	Power loss	●	●	●
9	Undercurrent			●
10	Heatsink overtemperature			●
11	Motor connection			●
12	Input A trip			●
13	FLC too high			●
14	Unsupported option (function not available in inside delta)			●
15	Starter communication (between module and soft starter)	●	●	●
16	Network communication (between module and network)	●	●	●
17	Internal fault x (where x is the fault code detailed in the table below)			●
23	Parameter out of range			●
26	L1 phase loss			●
27	L2 phase loss			●
28	L3 phase loss			●
29	L1-T1 shorted			●
30	L2-T2 shorted			●
31	L3-T3 shorted			●
32	Motor 2 overload			●
33 <sup>1</sup>	Time-overcurrent / Bypass overload		●	●
35	Battery/clock			●
36	Thermistor circuit			●

<sup>1</sup> For ASTAT XL, time-overcurrent protection is only available on internally bypassed models.





## 8.1 Internal Fault x

The table below details the internal fault code associated with trip code 17.

Internal fault	Message displayed on the keypad
70 ~ 72	Current Read Err Lx
73	Internal fault X Contact your local supplier with the fault code (X).
74 ~ 76	Motor Connection Tx
77 ~ 79	Firing Fail Px
80 ~ 82	VZC Fail Px
83	Low Control Volts
84 ~ 98	Internal fault X Contact your local supplier with the fault code (X).



### NOTE

Only available on ASTAT XL soft starters. For parameter details, see the soft starter User Manual.

## 9 Examples

Command: Start

Message	Starter Address	Function Code	Register Address	Data	CRC
In	20	06	40002	1	CRC1, CRC2
Out	20	06	40002	1	CRC1, CRC2

Starter status: Running

Message	Starter Address	Function Code	Register Address	Data	CRC
In	20	03	40003	1	CRC1, CRC2
Out	20	03	2	xxxx0011	CRC1, CRC2

Trip code: Motor overload

Message	Starter Address	Function Code	Register Address	Data	CRC
In	20	03	40004	1	CRC1, CRC2
Out	20	03	2	00000010	CRC1, CRC2

Download parameter from starter

ASTAT XL: Read Parameter 7, *Current Limit* (Parameter 2B), 350%

Message	Starter Address	Function Code	Register Address	Data	CRC
In	20	03	40015	1	CRC1, CRC2
Out	20	03	2 (bytes)	350	CRC1, CRC2



Upload single parameter to starter

ASTAT XL: Write Parameter 12, *Excess Start Time* (Parameter 2G), set = 10

Message	Starter Address	Function Code	Register Address	Data	CRC
In	20	06	40020	10	CRC1, CRC2
Out	20	06	40020	10	CRC1, CRC2

Upload multiple parameters to starter

ASTAT XL: Write Parameters 7, 8, 9 (parameters 2B *Current Limit*, 2C *Initial Current*, 2D *Start Ramp Time*). Set to values of 350%, 300%, 15 seconds respectively.

Message	Starter Address	Function Code	Register Address	Data	CRC
In	20	16	40015,3	350, 300, 15	CRC1, CRC2
Out	20	16	40015,3	350, 300, 15	CRC1, CRC2

**NOTE**

This function can only be used to upload consecutive parameters. The Register Address data indicates the number of parameters to be uploaded, and the register address of the first parameter.

**NOTE**

Parameter information can only be uploaded/downloaded from ASTAT XL starters.

## 10 Modbus Error Codes

Code	Description	Example
01	Illegal function code	Function other than 03 or 06
02	Illegal data address	Register number invalid
03	Not readable data	Register not allowed for data reading
04	Not writable data	Register not allowed for data writing
05	Data boundary fault	Multiple data transfer across data boundary or data size more than 125
06	Invalid command code	eg writing "6" into 40003
07	Illegal parameter read	Invalid parameter number
08	Illegal parameter write	Invalid parameter number, read only, or hidden parameter
09	Unsupported command	Sending a serial command to ASTAT XL with parameter 6B = Disable Control in RMT.
10	Local communication error	Communication error between Modbus slave and starter

**NOTE**

Some of the above codes are different from those defined in the Modbus Application Protocol Specification available on [www.modbus.org](http://www.modbus.org).



## 11 Modbus Control via Remote Operator

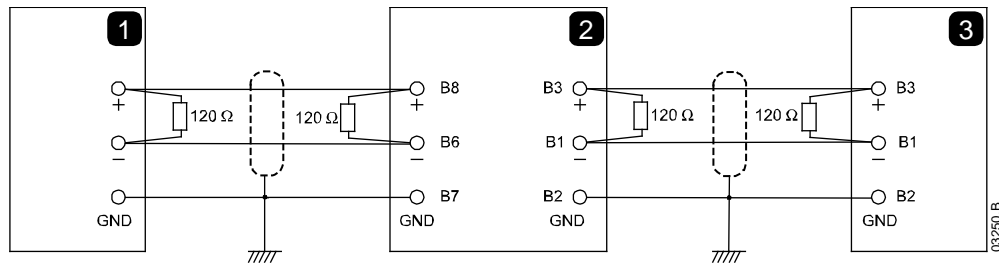
The Modbus Module can be used to connect a Remote Operator to the soft starter, enabling control via an RS-485 serial communications network. See the Remote Operator instructions for details on connecting the Remote Operator to the starter. Connect the Remote Operator to the network as described in the following sections.

### 11.1 Grounding and Shielding

Twisted pair data cable with earth shield is recommended. The cable shield should be connected to the GND device terminal at both ends and one point of the site protective earth.

### 11.2 Termination Resistors

In long cable runs prone to excessive noise interference, termination resistors should be installed between the data lines at both ends of the RS-485 cable. This resistance should match the cable impedance (typically 120  $\Omega$ ). Do not use wire wound resistors.



<b>1</b>	Network master RS-485
<b>2</b>	Remote Operator RS-485
<b>3</b>	Soft starter RS-485

### 11.3 RS-485 Data Cable Connection

Daisy chain connection is recommended. This is achieved by parallel connections of the data cable at the actual device terminals.

### 11.4 Remote Operator RS-485 Network Connection Specifications

Input impedance:	12 k $\Omega$
Common mode voltage range:	- 7 V to + 12 V
Input sensitivity:	$\pm$ 200 mV
Minimum differential output voltage:	1.5 V (with max loading of 54 $\Omega$ )



## 12 Specifications

### Enclosure

Dimensions ..... 40 mm (W) x 166 mm (H) x 90 mm (D)  
Weight ..... 250 g  
Protection ..... IP20

### Mounting

Spring-action plastic mounting clips (x 2)

### Connections

Soft starter ..... 6-way pin assembly  
Network ..... 5-way male and unpluggable female connector (supplied)  
Maximum cable size ..... 2.5 mm<sup>2</sup>

### Settings

Protocol ..... Modbus RTU, AP ASCII  
Address range ..... 0 to 31  
Data rate (bps) ..... 4800, 9600, 19200, 38400  
Parity ..... None, Odd, Even, 10-bit  
Timeout ..... None (off), 10 s, 60 s, 100 s

### Certification

C✓ ..... IEC 60947-4-2  
CE ..... IEC 60947-4-2  
RoHS ..... Compliant with EU Directive 2002/95/EC

