Instructions

Modbus RTU Card

(WSIQ-COM-MB)

Contents

Product Compatibility

The Modbus RTU Card is suitable for use with WSB and WSIQ soft starters.

Disclaimer

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.

1 Warnings

WARNING
For your safety, isolate the soft starter from mains voltage before attaching or removing accessories.

WARNING
Inserting foreign objects or touching the inside of the starter while the expansion port cover is open may endanger personnel, and can damage the starter.

2 Important User Information

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

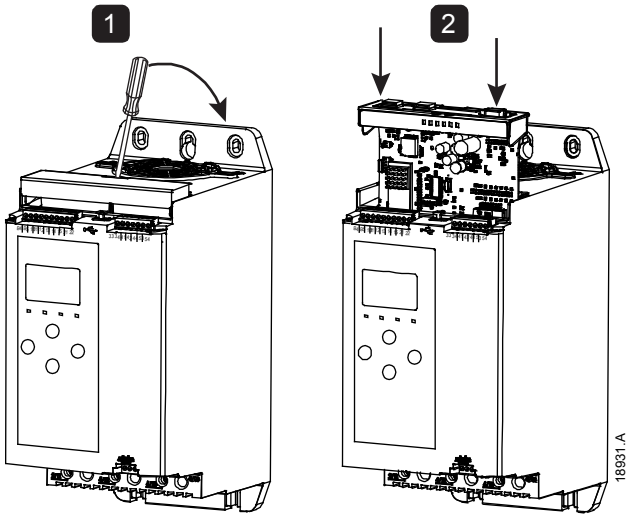
It is the installer's responsibility to follow all instructions in this manual and to follow correct electrical practice.

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

3 Installation

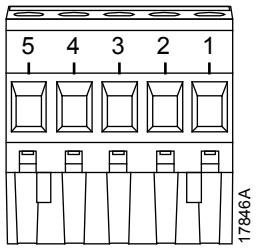
3.1 Installation Procedure

1. Push a small flat-bladed screwdriver into the slot in the centre of the expansion port cover, and ease the cover away from the starter.
2. Line up the card with the expansion port. Gently push the card along the guide rails until it clicks into the starter.



3.2 Connecting to the Network

After the card is in place, control power can be restored and field wiring can be connected via the 5-way connector plug.



Pin	Function
1, 2	Data A
3	Common
4, 5	Data B

4 Operation

The Modbus RTU Card must be controlled by a Modbus client (such as a PLC) which complies with the Modbus Protocol Specification. For successful operation, the client must also support all functions and interfaces described in this document.

4.1 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 in parameters 11A~11D.

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.

4.2 Configuration

Modbus Network Settings

Network communication parameters for the card must be set via the soft starter. For details on how to configure the soft starter, refer to the soft starter user manual.

Parameter	Parameter name	Description
11A	*Modbus Address*	Sets the Modbus RTU network address for the soft starter.
11B	*Modbus Baud Rate*	Selects the baud rate for Modbus RTU communications.
11C	*Modbus Parity*	Selects the parity for Modbus RTU communications.
11D	*Modbus Timeout*	Selects the timeout for Modbus RTU communications.

Enabling Network Control

The soft starter will only accept commands from the Modbus RTU Card if parameter 1A *Command Source* is set to Network.

NOTE
If the reset input is active, the starter will not operate. If a reset switch is not required, fit a link across terminals 10, 11 on the soft starter.

4.3 Feedback LEDs

LED Status	Description
Off	Soft starter not powered up
On	Communication active
Flashing	Communication inactive

NOTE
If communication is inactive, the soft starter may trip on Network Communications. If parameter 6G *Network Communications* is set to 'Soft Trip and Log' or 'Trip Starter', the soft starter will require a reset.

5 Modbus Registers

5.1 PLC Configuration

Use the register tables below to map registers within the module to addresses within the PLC.

NOTE
All references to registers mean the registers within the module unless otherwise stated.

5.2 Compatibility

The Modbus RTU Card supports two modes of operation.

- In Standard Mode, the device uses registers defined in the Modbus Protocol Specification.
- In Legacy Mode, the device uses the same registers as WorldWide Electric's Modbus device. Some registers differ from those specified in the Modbus Protocol Specification.

The mode of operation is determined by the values of bit 15 in register 40001.

- Standard Mode: set Bit 15 = 1. Bits 0~7 of register 40001 are used for command.
- Legacy Mode: set Bit 15 = 0. The remaining bits of register 40001 are reserved.

Examples

10000000 00000001 = start the motor (Standard Mode).

10000000 00000000 = stop the motor (Standard Mode).

00000000 xxxxxxxx = switch to Legacy Mode. The device will ignore the remaining bits in register 40001 and will check the value in register 40002.

5.3 Ensuring Safe and Successful Control

Data written to the Ethernet/IP Card will remain in its registers until the data is overwritten or the device is reinitialised.

If the soft starter may be controlled via Command Override (parameter 7A) or may be disabled via the reset input (terminals 10, 11) fieldbus commands should be cleared from the registers. If a command is not cleared, it will be re-sent to the starter once fieldbus control resumes.

5.4 Configuring Soft Starter Parameters

Parameter management is always multiple write of the entire parameter block.

When configuring parameters in the soft starter, the PLC must be programmed with the correct values for all parameters. The Modbus RTU Card will update every parameter in the starter to match the values in the PLC.

5.5 Standard Mode

Command and Configuration Registers (Read/Write)

Register	Description	Bits	Details
40001	Command (single write)	0 to 7	To send a command to the starter, write the required value: 00000000 = Stop 00000001 = Start 00000010 = Reset 00000100 = Quick stop (coast to stop) 00001000 = Forced communication trip 00010000 = Start using Parameter Set 1[1] 00100000 = Start using Parameter Set 2[1] 01000000 = *Reserved* 10000000 = *Reserved*
		8 to 14	*Reserved*
		15	Must = 1
40002	*Reserved*	0 to 7	
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	*Reserved*
40004	Trip code	0 to 7	Refer to *Trip Codes* on page 13
40005[2]	Motor current	0 to 7	Average 3-phase motor current (A)
40006	Motor temperature	0 to 7	Motor thermal model (%)
40007	Product information	0 to 2	Product parameter list version
		3 to 7	Product type code [3]
40008	Serial Protocol Version	0 to 7	Communication protocol between module and starter

Register	Description	Bits	Details
40009 [4] ~ 40200	Parameter management (single/multiple read or multiple write)	0 to 7	Manage soft starter programmable parameters

[1] Ensure that the programmable input is not set to Motor Set Select before using this function.

[2] For models WSx-0064BP and smaller this value will be 10 times greater than the value displayed on the keypad.

[3] Product type code:

12 = WSB

13 = WSIQ

[4] Refer to *Parameter Lists* 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. The Modbus RTU Card can read or write a maximum of 125 registers in one operation. These registers support multiple write (Modbus function code 16). Attempting to write to a single register will return an error code 01 (Illegal function code).

Status Reporting Registers (Read Only)

Register	Description	Bits	Details
30003	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	*Reserved*
30004 [1]	Trip code	0 to 7	Refer to *Trip Codes* on page 13
30005 [2]	Motor current	0 to 7	Average 3-phase motor current (A)
30006	Motor temperature	0 to 7	Motor thermal model (%)

Register	Description	Bits	Details
30007	Product information	0 to 2	Parameter list version number
		3 to 7	Product type code [3]
30008	Serial Protocol Version		
30600	Version	0 to 5	Binary protocol version
		6 to 8	Parameter list major version
		9 to 15	Product type code
30601	*Reserved*		
30602 [3]	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
30603 [3]	Changed parameter value	0 to 13	Value of the last parameter that was changed, as indicated in register 30252
		14 to 15	*Reserved*
30604	Starter state	0 to 4	0 = *Reserved* 1 = Ready 2 = Starting 3 = Running 4 = Stopping 5 = Not ready (restart delay, restart temperature check, run simulation, reset input is open) 6 = Tripped 7 = Programming mode 8 = Jog forward 9 = Jog reverse
		5	1 = Warning
		6	0 = Unintialised 1 = Initialised
		7	Command source 0 = Remote Keypad, Digital Input, Clock 1 = Network, Smart Card, Smart Card + Clock
		8	0 = Parameter(s) have changed since last parameter read 1 = No parameters have changed [3]
		9	0 = Negative phase sequence 1 = Positive phase sequence
		10 to 15	*Reserved*

Register	Description	Bits	Details
30605 [2]	Current	0 to 13	Average rms current across all three phases
		14 to 15	*Reserved*
30606	Current	0 to 9	Current (% motor FLC)
		10 to 15	*Reserved*
30607	Motor temperature	0 to 7	Motor thermal model (%)
		8 to 15	*Reserved*
30608	*Reserved*		
30609	% Power factor	0 to 7	100% = power factor of 1
		8 to 15	*Reserved*
30610	*Reserved*		
30611 [2]	Current	0 to 13	Phase 1 current (rms)
		14 to 15	*Reserved*
30612 [2]	Current	0 to 13	Phase 2 current (rms)
		14 to 15	*Reserved*
30613 [2]	Current	0 to 13	Phase 3 current (rms)
		14 to 15	*Reserved*
30614	*Reserved*		
30615	*Reserved*		
30616	*Reserved*		
30617	Parameter list version number	0 to 7	Parameter list minor revision
		8 to 15	Parameter list major version
30618	Digital Input state	0 to 15	For all inputs, 0 = open, 1 = closed (shorted) 0 = Start/Stop 1 = *Reserved* 2 = Reset 3 = Input A 4 = Input B 5 to 15 = *Reserved*
30619 [1]	Trip code	0 to 7	Refer to *Trip Codes* on page 13
		8 to 15	*Reserved*
30620~ 30631	*Reserved*		

[1] For models WSx-0064BP and smaller this value will be 10 times greater than the value displayed on the keypad.

[2] Product type code:

12 = WSB

13 = WSIQ

[3] Reading register 30603 (Changed parameter value) will reset registers 30602 (Changed parameter number) and 30604 (Parameters have changed). Always read registers 30602 and 30604 before reading register 30603.

5.6 Legacy Mode

Registers

	Description	Bits	Details
40001	*Reserved*	0 to 14	*Reserved*
		15	Must be zero
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 7 = Start using Parameter Set 2
		3 to 7	*Reserved*
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	*Reserved*
40004	*Reserved*		
40005 [1]	Motor current	0 to 7	Average 3-phase motor current (A)
40006	Motor temperature	0 to 7	Motor thermal model (%)
40007	*Reserved*		
40008	*Reserved*		

	Description	Bits	Details
40009 [3] ~ 40200	Parameter management (single/multiple read or multiple write)	0 to 7	Manage soft starter programmable parameters
40600	Version	0 to 5	Binary protocol version
		6 to 8	Parameter list version number
		9 to 15	Product type code [2]
40601	*Reserved*		
40602 [4]	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
40603 [4]	Changed parameter value	0 to 13	Value of the last parameter that was changed, as indicated in register 40602
		14 to 15	*Reserved*
40604	Starter state	0 to 4	0 = *Reserved* 1 = Ready 2 = Starting 3 = Running 4 = Stopping 5 = Not ready (restart delay, restart temperature check, run simulation, reset input is open) 6 = Tripped 7 = Programming mode 8 = Jog forward 9 = Jog reverse
		5	1 = Warning
		6	0 = Unintialised 1 = Initialised
		7	Command source 0 = Remote Keypad, Digital Input, Clock 1 = Network, Smart Card, Smart Card + Clock
		8	0 = Parameter(s) have changed since last parameter read 1 = No parameters have changed [3]
		9	1 = Positive phase sequence
		10 to 15	*Reserved*

	Description	Bits	Details
40605 [1]	Current	0 to 13	Average rms current across all three phases
		14 to 15	*Reserved*
40606	Current	0 to 9	Current (% motor FLC)
		10 to 15	*Reserved*
40607	Motor temperature	0 to 7	Motor thermal model (%)
		8 to 15	*Reserved*
40608	*Reserved*		
40609	% Power factor	0 to 7	100% = power factor of 1
		8 to 15	*Reserved*
40610	*Reserved*		
40611 [1]	Current	0 to 13	Phase 1 current (rms)
		14 to 15	*Reserved*
40612 [1]	Current	0 to 13	Phase 2 current (rms)
		14 to 15	*Reserved*
40613 [1]	Current	0 to 13	Phase 3 current (rms)
		14 to 15	*Reserved*
40614	*Reserved*		
40615	*Reserved*		
40616	*Reserved*		
40617	Parameter list version number	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/Stop 1 = *Reserved* 2 = Reset 3 = Input A 4 = Input B
40619	Trip code		Refer to *Trip Codes* on page 13
40620~ 40631	*Reserved*		

[1] For models WSx-0064BP and smaller this value will be 10 times greater than the value displayed on the keypad.

[2] Product type code:

12 = WSB

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[3] Refer to *Parameter Lists* 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. The Modbus RTU Card can read or write a maximum of 125 registers in one operation. These registers support multiple write (Modbus function code 16). Attempting to write to a single register will return an error code 01 (Illegal function code).

[4] 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.

5.7 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,CRC 2

Starter state: 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
Read Parameter 4 (1D *Locked Rotor Current*), 600%

Message	Starter Address	Function Code	Register	Data	CRC
In	20	03	40012	1	CRC1, CRC2
Out	20	03	2 (bytes)	600	CRC1, CRC2

Upload single parameter to starter
Write Parameter 14 (2I *Stop Mode*), set = 1

Message	Starter Address	Function Code	Register	Data	CRC
In	20	06	40022	1	CRC1, CRC2
Out	20	06	40022	1	CRC1, CRC2

Upload multiple parameters to starter

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

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

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

5.8 Trip Codes

Trip Code	Description
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 device and soft starter)
16	Network communication (between device and network)
17	Internal fault x (where x is the fault code detailed in the table below)
23	Parameter out of range
24	Input B trip
26	L1 phase loss
27	L2 phase loss
28	L3 phase loss
29	L1-T1 shorted
30	L2-T2 shorted
31	L3-T3 shorted
33	Time-overcurrent (Bypass overload)
34	SCR overtemperature
35	Battery/clock

Trip Code	Description
36	Thermistor circuit
49	Low Control Volts
56	Keypad disconnected
57	Zero Speed Detect
58	SCR Itsm
59	Instantaneous overcurrent
60	Rating Capacity

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	ATTENTION! Remove Mains Volts
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).

5.9 Modbus Error Codes

Code	Description	Example
01	Illegal function code	Function other than 03, 06 or 16
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 the starter with parameter *Command Source* set = Remote Keypad.
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.

6 Specifications

- **Connections**

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

- **Settings**

Protocol ..... Modbus RTU, AP ASCII
Address range ..... 0 to 254
Data rate (bps) 4800, 9600, 19200, 38400
Parity ..... None, Odd, Even, 10-bit
Timeout ..... None (Off), 10 s, 60 s, 100 s

- **Certification**

CE ..... EN 60947-4-2
RoHS ..... Compliant with EU Directive 2011/65/EU


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