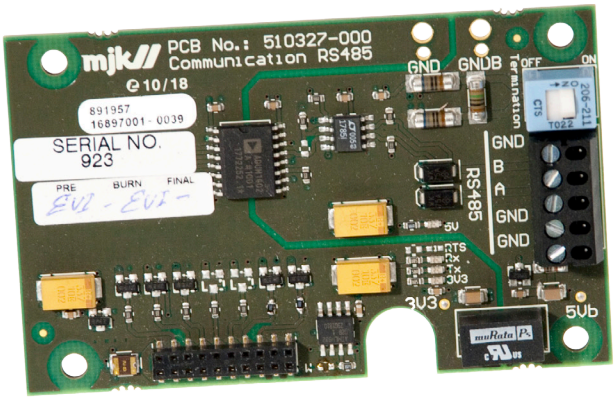
Modbus Communication Modules for Displays

Order no. 205546
Modbus and RS 485 Communication Module



Manual

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1. Introduction

Thank you for choosing MJK Modbus communication module. We have done our utmost to design and manufacture a high quality product that should satisfy your requirements.

The MJK modem and communication modules is easy to install in MJK MagFlux©, SuSix© and Oxix© units and to put into service. However, read this manual first to learn more about the specifications, how to install and how to operate the equipment.

The equipment must be handled and operated as instructed by the manufacturer, MJK Automation A/S, to ensure stable operation.

The MJK modem and communication modules can be obtained in several different versions supporting standard communication types and protocols like PSTN, GSM, GPRS, RS 232, RS 485, Modbus RTU, Profibus PA and Bluetooth. This manual covers Modbus RS 485.

You can always contact your local representative or the MJK hot lines for advice and guidance:

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- **Denmark** Tel.: +45 45 56 06 56 E-mail: mjk@mjk.dk
- **Norway** Tel.: +47 69 20 60 70 E-mail: mjk@mjk.no
- **Holland** Tel.: +31 251 672171 E-mail: mjknl@mjk.com
- **USA** Tel.: +1 847 482 8655 E-mail: mjkusa@mjk.com

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MJK Automation A/S is a Xylem brand.

2. Communication Modules

2.1 Modbus and RS 485 Communication Module

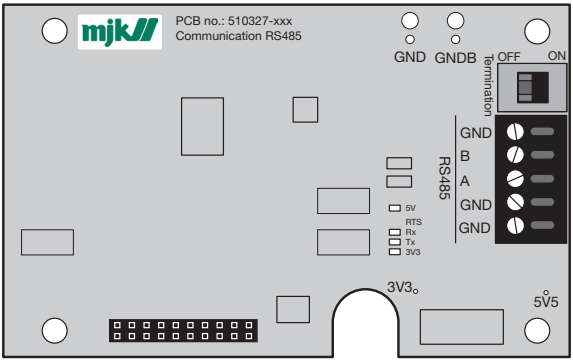


Figure 1. Modbus and RS 485 Communication Module

2.1.1 Version Requirements

The following software, firmware and hardware versions (or higher) are required for displays without an installed communication module:

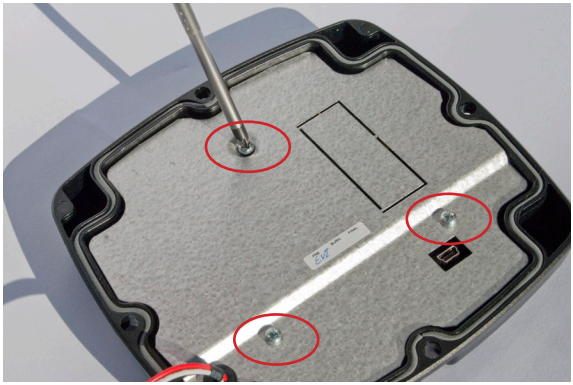
- Converter HW ver.: 807000
- Converter FW ver.: 842009-001
- Display HW ver.: 807056
- Display FW ver.; 841018-000
- Text file ver.: 841513-011
- MJK-Field Link ver.: 840110-48

2.1.2 Technical Specifications

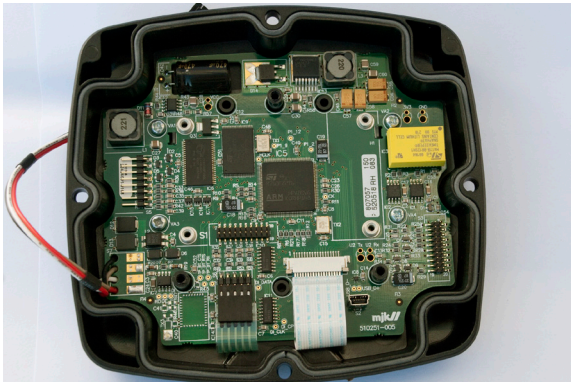
Specification	Description
Mounting	With 4 screws on transmitter's I/O board
Protection	IP 20
Dimensions	51 x 82 mm (H x W)
Connectors	One 5-position plugable screw terminal and one 20-pin bus connector
Temperature	-20 to +60 °C
Settings	One "Termination" dip switch
LEDs	White LEDs for "5V", "Rx", "Tx" and "3V3"
Power consump.	Approx. 0.18 VA
Com. type	RS 485 asynchronous, half duplex
Baud rate	300, 1200, 4800, 9600, 19200, 38400, 57600, 115200
Parity	Even, odd, none
Stop bits	1 , 2
Modbus ID offset	0 - 240
Protocol	Modbus RTU

Table 1. Specifications - Modbus and RS 485 Communication Module

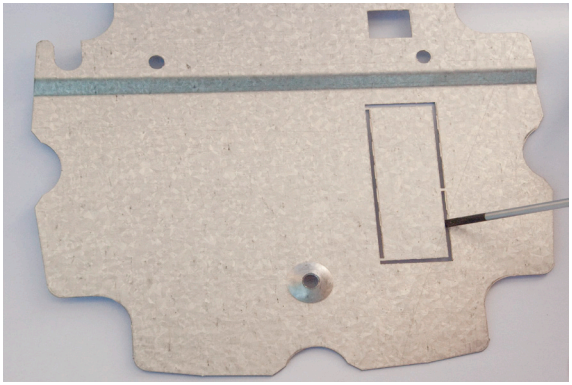
2.1.3 Physical mounting of Modbus module



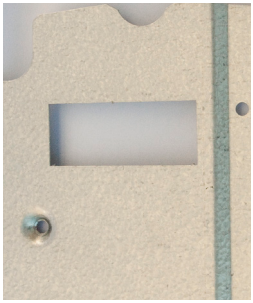
1. Dismount screws

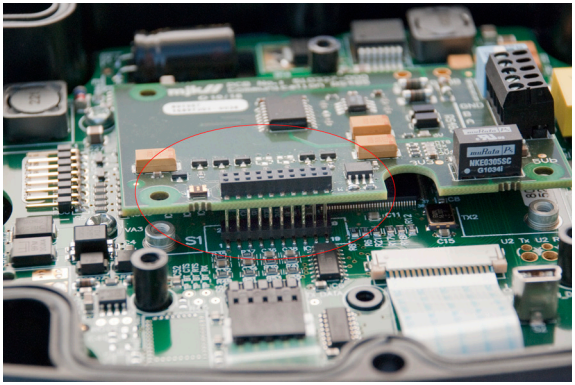


2. Remove back plate

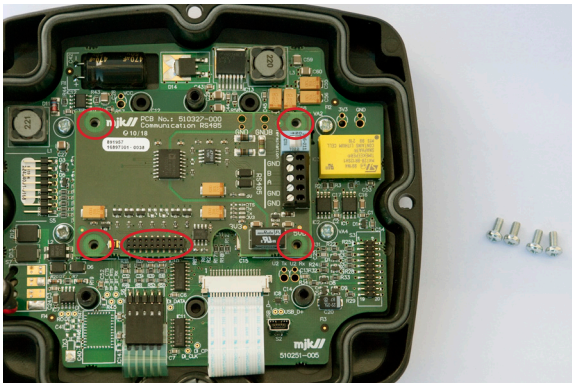


3. Remove lid using a screwdriver

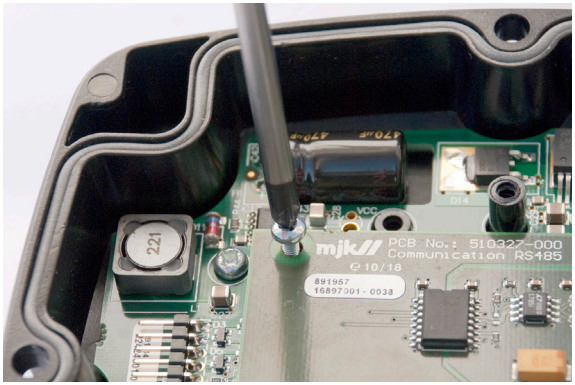




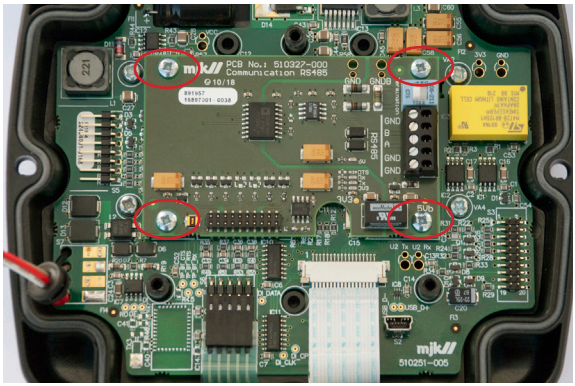
4. Align pins with contacts



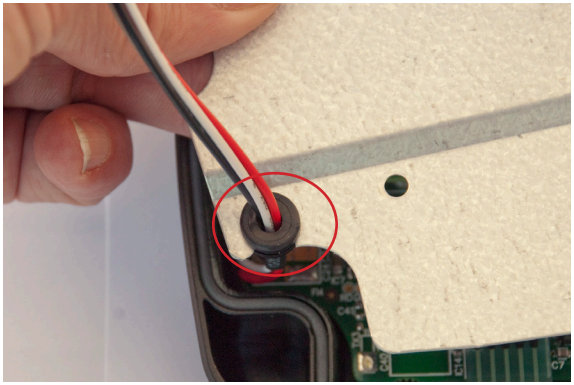
5. Check all pins is in place in the Modbus slot and check placing for screws



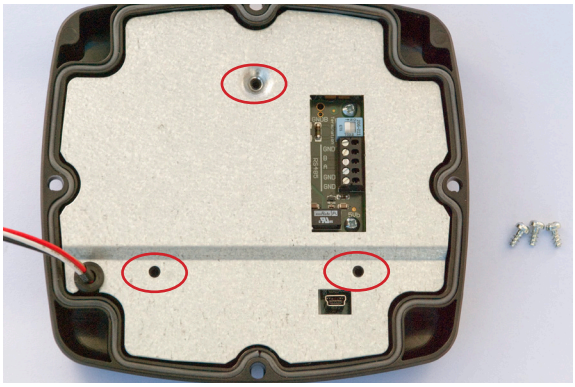
6. Secure module using 4 screws



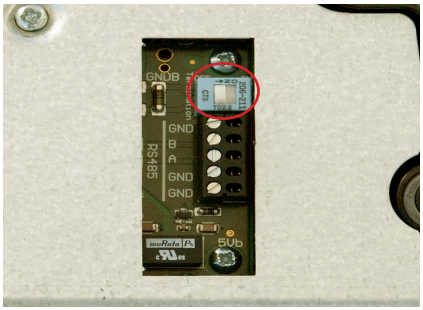
7. Ensure all 4 screws are in place

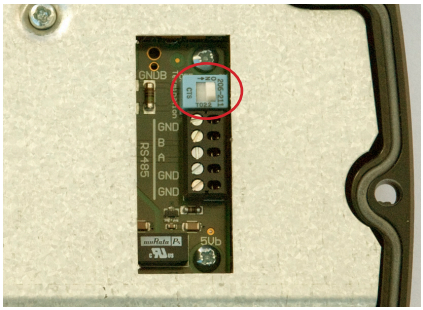


8. Make sure the rubber protection for cable is in place



9. Remount the back using the 3 screws





10. Terminal should be “ON” if the display is last or only in chain

2.1.4 Configuration Remarks

- The connected units on the Modbus have unique assigned IDs built as follows:
  SRO modbus ID = Instrument modbus ID + modbus ID offset
- ID 0 (broadcast) cannot be used (a broadcast is used for synchronous transmission of messages to all connected units).
- Available registers are limited to the measured value registers of the individual units. Configuration settings cannot be accessed.
- The PLC time-out on the Modbus must be set to 5 seconds from the SCADA system or the master PLC unit.
- COM module configuration/setup is executed from the “Display Setup/ Communication” menu (see below).
- The “Communication” option in the display menu automatically appears, when a communication module is connected to the display.

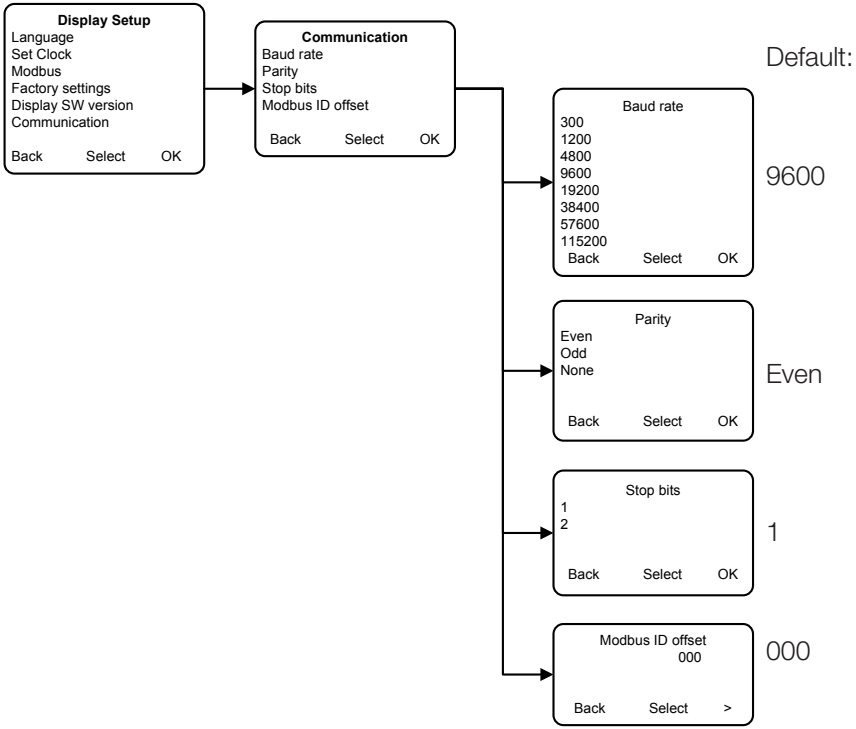


Figure 2. COM Module Configuration

2.1.5 Connection Examples

2.1.5.1 One Connected Unit

This example illustrates connection, termination and ID configuration of a single unit with a communication module and a PLC.

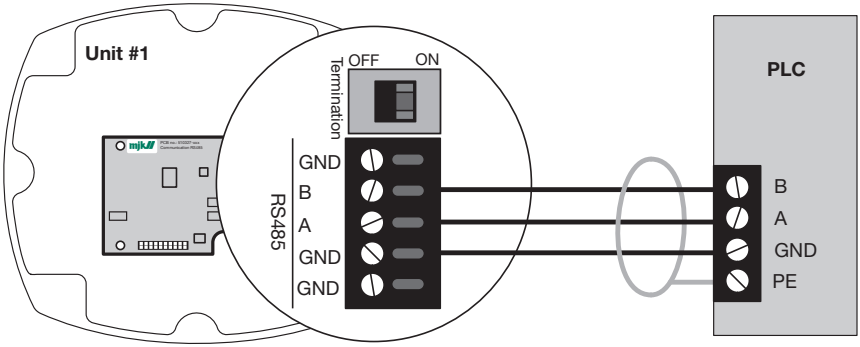


Figure 3. One Connected Unit

Exampe ID settings

If the connected unit has ID=1 (seen from the com module), and the com module has ID offset=200, the SRO Modbus ID is “201” (200 + 1, seen from the PLC).

Termination

Modbus RS 485 communication requires bus termination. Therefore the connected COM module’s termination dip switch is set in “ON” position.

2.1.5.2 Three Connected Units

This example illustrates connection, termination and ID configuration of three units each with a communication module and a PLC.

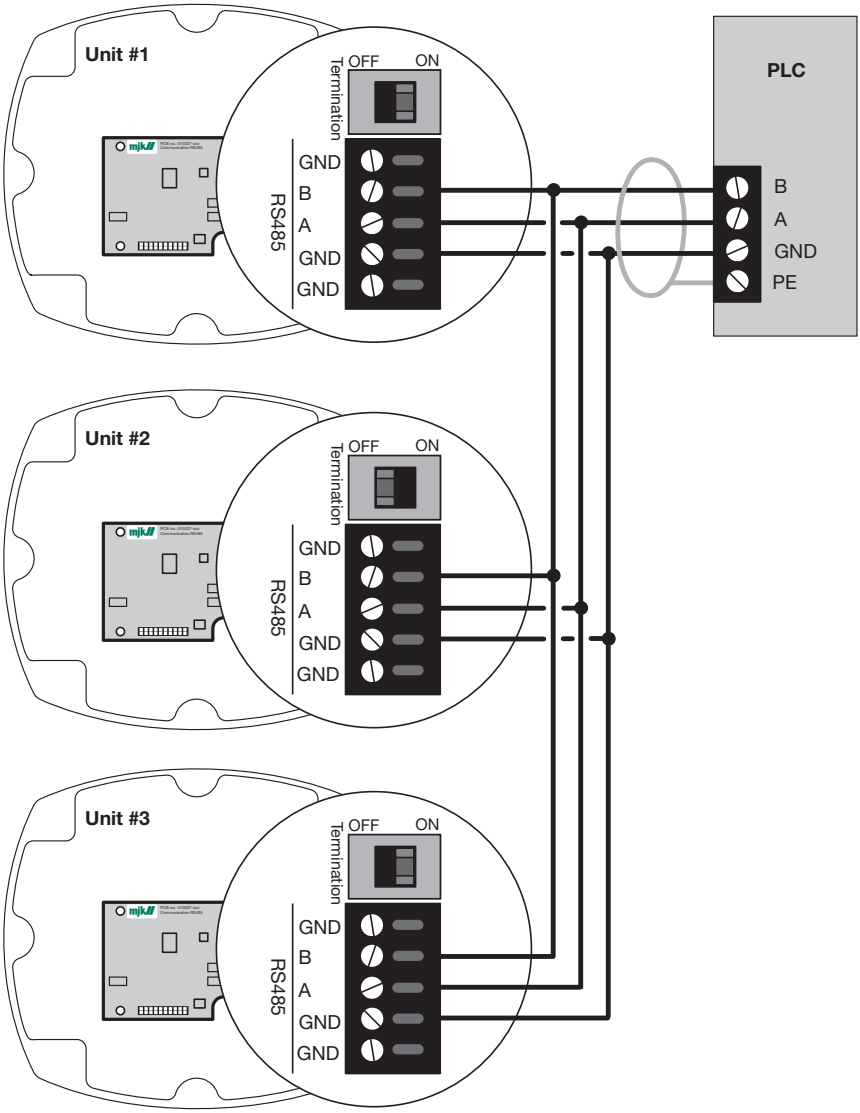


Figure 4. Three Connected Units

Exampe ID settings

Unit #1 ID=1 and COM module offset ID=1 -> SRO ID=2 (1 + 1)

Unit #2 ID=1 and COM module offset ID=2 -> SRO ID=3 (1 + 2)

Unit #3 ID=4 and COM module offset ID=3 -> SRO ID=7 (4 + 3)

Termination

Modbus RS 485 communication requires bus termination. If the PLC is terminated, unit #1 must be set in “OFF” position, unit #2 in “OFF” position and unit #3 in “ON” position.

If, on the other hand, the PLC is **NOT** terminated, unit #1 must be set in “ON” position.

2.1.5.3 Three Connected Units and One Common Display

This example illustrates connection and ID configuration of for example three MagFlux units without display, one common, remote display unit with a communication module and a PLC unit.

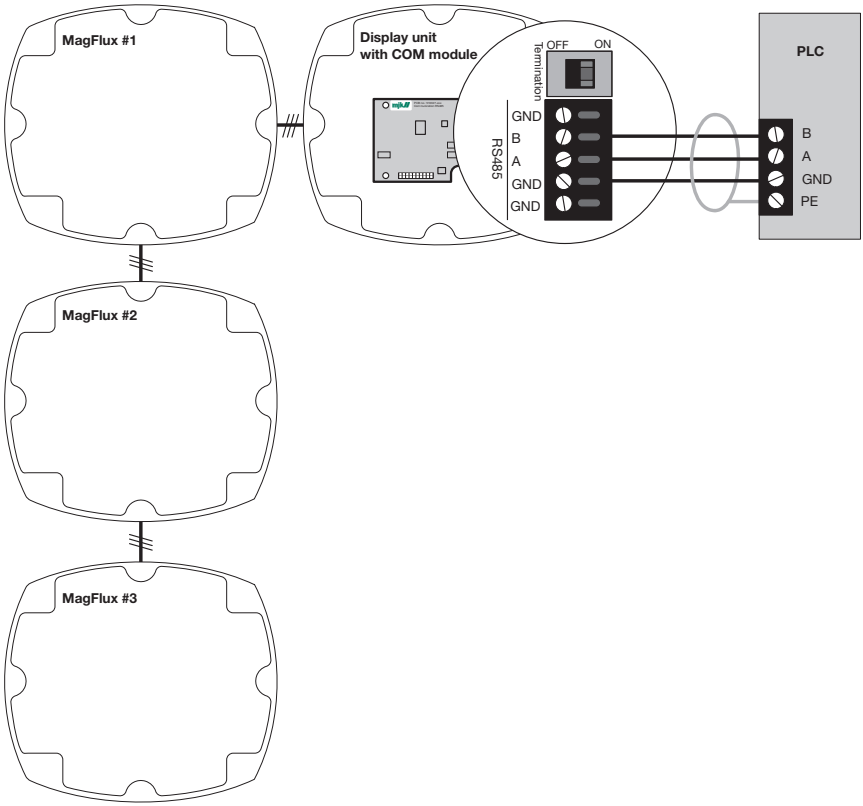


Figure 5. Three Connected Units and One Common Display Unit

Exampe ID settings

If Magflux #1 has ID=1 (seen from the com module), and the com module has ID offset=100, the SRO Modbus ID is 101 (100 + 1) seen from the PLC.

Likewise the other MagFlux units with ID=2 and ID=3 would have the SRO Modbus IDs 102 and 103.

3. Order Numbers

Order number	Communication Module
205546	MODBUS and RS 485 communications module

4. Register Lists

4.1 MagFlux Register List

- Date: 2009-03-10
- Firmware: 842009-001
- Protocol: Modbus RTU
- Transfer rate: 9600 baud
- Format for serial com: 1-Startbit, 8-Databits, 1-Parity (Even), 1-Stopbit
- Password: OFF (default)
- To set up the converter, use the MagFlux Display Unit

When a MagFlux Converter is connected to an external master, for example a PLC or an HMI interface, the MagFlux Display Unit can not be used simultaneous on the RS 485 communication port.

Support only Read is ”func. 03 (0x03) Read Holding Registers” or ”func. 04 (0x04) Read Input Registers” and write ”func. 16 (0x10) Write Multiple registers”

Register address	Register name	Type	Security	Read/ Write	Comments
Flow now					
600	Flow now	F32 {low}	None	Read-only	Flow now [m3/sec]
601	Flow now	F32 {high}	-	-	Flow now [m3/sec]
Totalizer Forward					
604	Total forward flow 1 - LS word	U64{1}	None	Read-only	Forward total [mm3]
605	Total forward flow 1 - 2	U64{2}	-	Read-only	Forward total [mm3]
606	Total forward flow 1 - 3	U64{3}	-	Read-only	Forward total [mm3]
607	Total forward flow 1 - MS word	U64{4}	-	Read-only	Forward total [mm3]
608	Resetable total forward flow 2 - value	U32 {low}	Password	Read/ Reset	Forward total [liter]
609	Resetable total forward flow 2 - value	U32 {high}	-	Read/ Reset	Forward total [liter]
Totalizer Reverse					
610	Total reverse flow 1 - LS word	U64{1}	None	Read-only	Reverse total [mm3]
611	Total reverse flow 1 - 2	U64{2}	-	Read-only	Reverse total [mm3]

Register address	Register name	Type	Security	Read/ Write	Comments
612	Total reverse flow 1 - 3	U64{3}	-	Read-only	Reverse total [mm3]
613	Total reverse flow1 - MS word	U64{4}	-	Read-only	Reverse total [mm3]
614	Resetable total reverse flow 2 - value	U32 {low}	Password	Read/ Reset	Reverse total [liter]
615	Resetable total reverse flow 2 - value	U32 {high}	-	Read/ Reset	Reverse total [liter]
Totalizer Sum					
616	Total sum flow 1 - LS word	S64{1}	None	Read-only	Sum total [mm3] Sum total= (Forward + Reverse) {exsample. 12 + (-2) =10 mm3}
617	Total sum flow 1 - 2	S64{2}	-	Read-only	See above
618	Total sum flow 1 - 3	S64{3}	-	Read-only	See above
619	Total sum flow 1 - MS word	S64{4}	-	Read-only	See above
620	Resetable total sum flow 2 - value	S32 {low}	Password	Read/ Reset	Sum total [liter]
621	Resetable total sum flow 2 - value	S32 {high}	-	Read/ Reset	Sum total [liter]
Batch Counter 1					
627	Batch counter 1 - Batch count	U32 {low}	Pass-word*	R/Reset	(* = password can be disabled for this setting)
628	See above	U32 {high}	-	-	
629	Batch counter 1 - value batch now	F32 {low}	None	Read-only	
630	See above	F32 {high}	-	-	
631	Batch counter 1 - value batch missing	F32 {low}	None	Read-only	
632	See above	F32 {high}	-	-	
Batch Counter 2					
633	Batch counter 2 - batch count	U32 {low}	Pass-word*	R/Reset	(* = password can be disabled for this setting)
634	See above	U32 {high}	-	-	
635	Batch counter 2 - value batch now	F32 {low}	None	Read-only	
636	See above	F32 {high}	-	-	

Register address	Register name	Type	Security	Read/ Write	Comments
637	Batch counter 2 - value batch missing	F32 {low}	None	Read-only	
638	See above	F32 {high}	-	-	

Status I/O Bits

Register address	Register name	Type	Security	Read/Write
1001	System error bit 1-16	B16	None	Read-only
	Bits			
	System error bit { on = 1 & off = 0 } (to force zero write 12(0x0C) in address 5120) Bit 1 = Factory reset has occurred (some settings have changed) Bit 2 = Eeprom write error (see log for details) Bit 3 = Flow totalizer eeprom error (None-resetable counter may be invalid in Eprom) Bit 4 = Sensor setting error (some settings are invalid or changed) Bit 5 = Counter output Forward Pulsoverflow (too low puls volume) Bit 6 = Counter output Reverse Pulsoverflow (too low puls volume) Bit 7 = Batch1 counter overflow Bit 8 = Batch2 counter overflow Bit 9 = Flow totalizer overflow (none-resetable counter may be invalid in Eprom) Bit 10-16 = Reserved and read-value is 0 (zero)			

Register address	Register name	Type	Security	Read/Write
1002	Alarm / sensor error	B16	None	Read-only
	Bits			
	Status bit resetable { On = 1 & Off = 0 } Bit 1 = empty pipe (see settings for possible enable / disable and on delay) Bit 2 = low flow (see settings for possible enable / disable and on delay) Bit 3 = high flow (see settings for possible enable / disable and on delay) Bit 4 = mA flow error (flow is over or under possibel output) Bit 5 = output coil error (see settings for possible enable / disable and on delay) Bit 6 = sensor error (see settings for possible enable / disable and on delay) Bit 7 = mA out not connected (see settings for possible enable / disable and on delay) Bit 8 = Input over range error (see settings for possible enable / disable and on delay) Bits 9-16 = Reserved and read-value is 0 (zero)			

Register address	Register name	Type	Security	Read/Write
1003	Status bits (Part 1)	B16	None	Read-only
	Bits			
	Bit 1 = batch counter 1 - batch is ended = 1 / running = 0 Bit 2 = batch counter 2 - batch is ended = 1 / running = 0 Bit 3 = batch counter 1 - too big adaptive batch error = 1 / no error = 0 Bit 4 = batch counter 2 - too big adaptive batch error = 1 / no error = 0 Bits 5-16 = reserved			

Register address	Register name	Type	Security	Read/Write
1004	Status bits (Part 2)	B16	None	Read-only
	Bits			
	Bit 1 = flow direction bit - forward flow = 0 / reverse flow = 1 (see settings for possible delay) Bit 2 = flow direction bit - A = 0 / B = 1 (see settings for possible delay) Bits 3-16 = reserved and read-value is 0 (zero)			

Login					
5000	Login - value	U16	None	Read/ Write	Write = 0 or 65535 to logout
5001	Min.	U16	None	Read-only	0
5002	Max.	U16	None	Read-only	65.535
5003	Login status - value	U16	None	Read/ Write	Login status read = { 65535 = lockout mode - 0 = no code - 1 = code accepted }
5004	Not in use	U16	None	None	
5005	Not in use	U16	None	None	
Batch Counter 1					
6703	Stop / Start / Pause Manual Batch - value	U16	None	R/W	Stop / start / pause start manual batch 0 = stop 1 = start 2 = pause
6704	Min.	U16	None	Read-only	0
6705	Max.	U16	None	Read-only	2
6706	Batch stop volume - value	F32 {low}	Pass-word*	Read/ Write	[m^3] (* = password can be disabled for this setting)
6707	See above	F32 {high}	-	-	
6708	Min.	F32 {low}	None	Read-only	
6709	See above	F32 {high}	-	-	
6710	Max.	F32 {low}	None	Read-only	
6711	See above	F32 {high}	-	-	
Batch Counter 2					
6753	Stop / Start / Pause Manual Batch - value	U16	None	Read/ Write	Stop / start / pause start manual batch 0 = stop 1 = start 2 = pause “
6754	Min.	U16	None	Read-only	0

6755	Max.	U16	None	Read-only	2
6756	Batch stop volume - value	F32 {low}	Pass-word*	Read/ Write	[m^3] (* = password can be disabled for this setting)
6757	See above	F32 {high}	-	-	
6758	Min.	F32 {low}	None	Read-only	
6759	See above	F32 {high}	-	-	
6760	Max.	F32 {low}	None	Read-only	
6761	See above	F32 {high}	-	-	

Table 2. MagFlux Register List

4.2 Oxix / SuSix Register List

- Date: 2009-03-10
- Firmware: 846001
- Protocol: Modbus RTU
- Transfer rate: 9600 baud
- Format for serial com: 1-Startbit, 8-Databits, 1-Parity (Even), 1-Stopbit
- Password: OFF (default)
- To set up the converter, use the SuSix/Oxix Display Unit

When a SuSix/Oxix Converter is connected to an external master, for example a PLC or an HMI interface, the SuSix/Oxix Display Unit can not be used simultaneous on the RS 485 communication port.

Support only Read is ”func. 03 (0x03) Read Holding Registers” or ”func. 04 (0x04) Read Input Registers” and write ”func. 16 (0x10) Write Multiple registers”

Reg. addr.	Reg. name	Type	Se-curity	Read/ Write	Oxix	SuSix
606	Read-ing - prim - xtra	F32 {LW}	None	Read-only	Primary value (dissolved oxygen) [unit is setting dependent]	Primary value (turbidity / solid) [unit is setting-de-pendent]
607	See above	F32 {HW}			See above	See above
608	Read-ing - sec - xtra	F32 {LW}	None	Read-only	Secondary value [de-grees C]	Secondary value standard deviation turbidity / solid [%]
609	See above	F32 {HW}			See above	See above

Status I/O Bits

Register address	Register name	Type	Security	Read/Write
1001	System error bit (alarm)	B16	Password	Read/Reset
	Bits			
	Oxix System error bit { on = 1 & off = 0 } Bit 1 = Factory reset has occurred (some settings have changed - check all used settings) Bit 2 = Eeprom write error (see log for details) Bit 3 = Sensor setting error (some settings are invalid or changed) Bit 4 = System error in eventlog (log in eventlog for details) Bit 5 = Current out not connected (If current out is not used, deactivate to stop pop-up) Bit 6 = Primary measurement is over or under settings for current Bits 7-16 = Reseved and read-value is 0 (zero) **SuSix** System error bit { on = 1 & off = 0 } Bit 1 = Factory reset has occurred (some settings have changed - check all used settings) Bit 2 = Eeprom write error (See log for details) Bit 3 = Sensor setting error (some settings are invalid or changed) Bit 4 = System error in eventlog (log in eventlog for details) Bit 5 = Current out not connected (if current out is not used, deactivate to stop pop-up) Bit 6 = Primary measurement is over or under settings for current Bits 7-16 = Reseved and read-value is 0 (zero)			

Register address	Register name	Type	Security	Read/Write
1002	System alarm 1	B16	None	Read-only
	Bits			
	Oxix Status bit { on = 1 & off = 0 } Bit 1 = reseved Bit 2 = reseved Bit 3 = reseved Bit 4 = primary value - low alarm active Bit 5 = primary value - high alarm active Bits 6-16 = reseved and read-value is 0 (zero) **SuSix** Status bit { on = 1 & off = 0 } Bit 1 = reseved Bit 2 = reseved Bit 3 = reseved Bit 4 = primary value low - alarm active Bit 5 = primary value high - alarm active Bits 6-16 = reseved and read-value is 0 (zero)			

Status I/O Bits

Register address	Register name	Type	Security	Read/Write
1003	Sensor error (Alarm)	B16	None	Read-only
	Bits			
	Oxix Status bit { on = 1 & off = 0 } Bit 1 = sensor - replace sensor Bit 2 = sensor - fix error / redo calibration point or clear all points and redo calibration Bit 3 = sensor - temperature error (thermistor is damaged) Bit 4 = sensor - check sensor cable Bit 5 = sensor - check sensor wiper Bit 6 = sensor - probe polluted => clean - if message is repeated, return probe Bit 7 = sensor - main photo diode saturated (circuit or sensor coating damaged) Bit 8 = sensor - main photo diode negative (excessive electrical noise or damage) Bit 9 = sensor - reference photo diode saturated (same causes as bit 7) Bit 10 = sensor - reference photo diode negative (same causes as bit 8) Bit 11 = reseved - read-value is 0 (zero) Bit 12 = reseved - read-value is 0 (zero) Bit 13 = reseved - read-value is 0 (zero) Bit 14 = reseved - read-value is 0 (zero) Bit 15 = sensor - supply is to high / low. Check sensor connection Bit 16 = sensor - temperature error (temperature is out of range) **SuSix** Status bit { on = 1 & off = 0 } Bit 1 = sensor - replace sensor Bit 2 = sensor - fix error / redo calibration point or clear all points and redo calibration Bit 3 = sensor - is not in solid mode - choose a unit of solid type Bit 4 = sensor - check sensor cable Bit 5 = sensor - check sensor wiper Bit 6 = sensor - probe polluted => clean - if message is repeated, return probe Bit 7 = sensor - turbidity value out of range (higher then 4000 NTU) - only implemented to display unexpected error Bit 8 = sensor - calibration insufficient - make another calibration on lower solid test sample Bit 9 = sensor - calibration insufficient - make another calibration on higher solid test sample Bit 10 = sensor - overflow - clean sensor / or check range and ensure that probe is used to measure Bit 11 = sensor - offset error (only implemented to display unexpected error Bit 12 = sensor - measuring start failed - please try again Bit 13 = sensor - measuring timeout - try again Bit 14 = sensor - measuring adjustment missing Bit 15 = sensor - supply is to high / low. Check sensor connection Bit 16 = reseved and read-value is 0 (zero)			

Status I/O Bits				
Register address	**Register name**	**Type**	**Security**	**Read/Write**
1004	Status no. 1	B16	None	Read-only
	Bits			
	Oxix Bit 1 = converter has experienced a software or hardware reset (expected if sensor number has been changed or factory setting is reloaded) Bit 2 = system error alarm (see settings for possible enable / disable and on delay) Bit 3 = sensor error alarm (see settings for possible enable / disable and on delay) Bit 4 = sensor autodetect type is running - normal if sensor com error is detected x times Bit 5 = hold of measurment value (normal for a short time) Bit 6 = sensor cleaning in progress Bit 7 = limit control **SuSix** Status bit { on = 1 & off = 0 } Bit 1 = converter has experience a software or hardware reset (expected if sensor number has been changed or factory setting is reloaded) Bit 2 = system error alarm (see settings for possible enable / disable and on delay) Bit 3 = sensor error alarm (see settings for possible enable / disable and on delay) Bit 4 = sensor autodetect type is running - normal if sensor com error is detected x times Bit 5 = hold of measurment value (normal for a short time) Bit 6 = sensor cleaning in progress Bit 7 = limit control			

Login						
Reg. addr.	**Reg. name**	**Type**	**Se-cu-rity**	**Read/ Write**	**Oxix**	**SuSix**
5000	Login - Value	U16	None	Read/ Write	Write = 0 or 65535 to logout	Write = 0 or 65535 to logout
5001	Min.	U16	None	Read-only	0	0
5002	Max.	U16	None	Read-only	65.535	65.535
5003	Login status - value	U16	None	Read/ Write	Login status Read = { 65535 = lockout mode - 0 = no code - 1 = code accepted }	Login status Read = { 65535 = lockout mode - 0 = no code - 1 = code accepted }
5004	Not in use	U16	None	None		
5005	Not in use	U16	None	None		

Table 3. Oxix and SuSix Register List

4.3 mA-Bus Converter List

- Date: 2008-06-11
- Firmware: 845001-003
- Protocol: Modbus RTU
- Transfer rate: 9600 baud
- Format for serial com: 1-Startbit, 8-Databits, 1-Parity (Even), 1-Stopbit
- Password: OFF (default)
- To set up the converter, use the Display Unit

When a mA-Bus Converter is connected to an external master, for example a PLC or an HMI interface, the Display Unit can not be used simultaneous on the RS 485 communication port. Support only Read is "func. 03 (0x03) Read Holding Registers" or "func. 04 (0x04) Read Input Registers" and write "func. 16 (0x10) Write Multiple registers"

Reg. addr.	Reg. name	Type	Se-cu-rity	Read/ Write	
100	DI 3-1 status	U16	None		
200	Digital input Bit 1-16	U16			
300	AI 1 Scaled value	F32 {Low}	None		
301	-	F32 {High}			
302	AI 1 Unit	U16			
303	AI 1 Precision	S16			
304	AI 2 Scaled value	F32 {Low}	None		
305	-	F32 {High}			
306	AI 2 Unit	U16			
307	AI 2 Precision	S16			
1001	System Error bit 1-16	U16			
1002	Alarm Error 1	U16			
1003	Alarm Error 2	U16			

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MJK Automation A/S is liable to the common rules of Danish law on product liability. However, the liability is reduced to coverage of our public liability insurance of products. To the extent where nothing else follows in lines of invariable rules of law, we are not liable for loss of profits and working deficits or other indirect losses.

Changes

As our products are developed continuously, we reserve the right to make any alterations without prior notice..

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