Installation instructions
Modbus Interface
Type: 166MI_2R

Argus Vision

Version 1.4
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Changes to this document

Version	Author	Date	Changes
1.0	RFE	5 June 2008	Initial version
1.1	RFE	10 June 2008	Updated holding register table
1.2	RFE	20 June 2008	Added write single holding register description
1.3	RFE	26 June 2008	Added reset and read write control description
1.4	RFE	1 July 2008	Added SUMMER_FAN, OPTION and HEATING_PROGRAM description

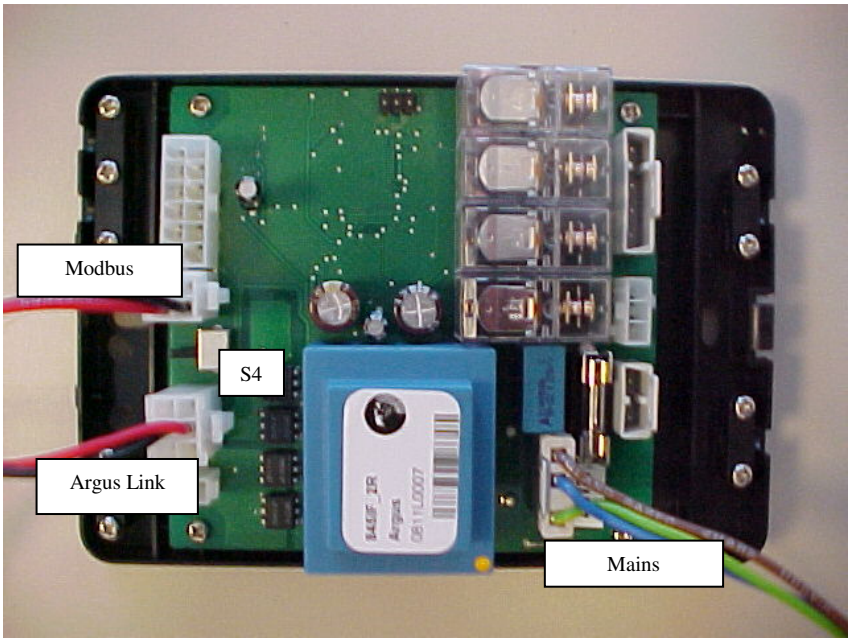
Contents

1 Modbus1 implementation.

The 166MI_2R board is provided with two Modbus ports (Modbus1 and Modbus2). Software is implemented for Modbus1 port only at this moment. Due to limited buffer size in the 166MI_2R a maximum of 8 registers, at one time (per frame) can be read.

1.1 Modbus configuration.

The picture below shows the connections to the interface board;



S4 is the power switch for the Argus Link bus. In systems where the main board (HC/HA) supplies the power to the Argus Link Bus, it should be switched off. To switch it off, slide it towards J4 (as shown in the PCB layout in chapter 1). For more details about connections refer to chapter 2.

The default setting for the Modbus (slave) address is 1. The address setting resides in the e2prom of the 166MI_2R and may be changed if required. This can be done with the help of LabVision via the Argus link connection (See appendix). Please keep in mind that the power to the interface must be switched off, and on again, after changing the Modbus slave address.

The table below describes the Modbus1 configuration details;

Modbus configuration	
Protocol	Modbus RTU
Default slave address	0x01 (settable with LabVision)
Supported Modbus commands	• Read Holding registers (0x03) • Write single holding register (0x06)
Baudrate	9600bps
Data Length	8
Parity	None
Stop Bits	1
Physical layer	RS485 (two wire)
Modbus 1 A connection	J7-1
Modbus 1 B connection	J7-3

1.2 Holding register description.

Modbus communicates using words (the contents of 16bit holding registers). The data that is offered by the 166MI_2R is organised as a list of bytes. The table below shows the parameters available for reading and their address (of the holding registers).

Read only holding registers							
Item index		Parameter name	Argus link device address (Name) and holding registers				
Word	byte		1 (RC)	100 (HC0)	101 (HC1)	…	108 (HC8)
0 High byte	0	STATE		0x0000	0x0010	…	0x0080
0 Low byte	1	ERROR_NUMBER		0x0000	0x0010	…	0x0080
2 High byte	2	T_CHIMNEY_HI		0x0002	0x0012	…	0x0082
2 Low byte	3	T_CHIMNEY_LO		0x0002	0x0012	…	0x0082
4 High byte	4	T_EXCHANGE_1_HI		0x0004	0x0014	…	0x0084
4 Low byte	5	T_EXCHANGE_1_LO		0x0004	0x0014	…	0x0084
6 High byte	6	T_EXCHANGE_2_HI		0x0006	0x0016	…	0x0086
6 Low byte	7	T_EXCHANGE_2_LO		0x0006	0x0016	…	0x0086
8 High byte	8	T_AMBIENT_HI		0x0008	0x0018	…	0x0088
8 Low byte	9	T_AMBIENT_LO		0x0008	0x0018	…	0x0088
10 High byte	10	FLAMEROD		0x000A	0x001A	…	0x008A
10 Low byte	11					…	
12 High byte	12	ROOM_TEMP_HI	0x000C				
12 Low byte	13	ROOM_TEMP_LO	0x000C				
14 High byte	14						
14 Low byte	15						

The table below summarises the parameters available for writing and the address of the corresponding holding registers.

Read / Write holding registers							
Item index		Parameter name	Argus link device address (Name) and holding registers				
Word	byte		100 (HC0)	101 (HC1)	…	108 (HC8)	1 (RC)
0 High byte	0	ROOM_SETPOINT_DAY					0x0090
0 Low byte	1	ROOM_SETPOINT_NIGHT					0x0090
2 High byte	2	ROOM_SETPOINT_FROST					0x0092
2 Low byte	3	ROOM_SETPOINT_OFFSET					0x0092
4 High byte	4	ROOM_TEMP_CORR_HI					0x0094
4 Low byte	5	ROOM_TEMP_CORR_LO					0x0094
6 High byte	6	SUMMER_FAN					0x0096
6 Low byte	7	HEATING_PROGRAM					0x0096
8 High byte	8	OPTION					0x0098
8 Low byte	9						
10 High byte	10						
10 Low byte	11						
12 High byte	12						
12 Low byte	13						
14 High byte	14	Reset & R/W control	0x000E	0x001E	…	0x008E	0x009E
14 Low byte	15	Reset & R/W control	0x000E	0x001E		0x008E	0x009E

Depending on the type of Modbus software used, the holding register addressing range starts either at 0x0000 or at 0x0001. If your Modbus software starts at 0x0000 you can use the holding register addresses shown in the tables above. If your Modbus software addressing range starts from 0x0001 then add 1 to the holding register addresses listed in the tables above. This is also true for the various test tools available for Modbus…

- Tabdial32 starts at 0x0000. (http://www.leroy-automation.com/LEROY%20AUTOMATION%20documentations.html) The Tabdial32 tool does not support the write single holding register command.
- Modbus Tester (http://www.modbus.pl/downloads.htm) starts at 0x0001. The Modbus tester tool does not support writing.

Also keep in mind that;

- After powering up the heating system it takes a while before all Argus link devices are online and thus before all Holding registers are filled with the correct, up to date, data.

1.3 Checking HC state and resetting of HC.

Reading holding register 0x0000 returns a word. The high byte of that word contains STATE of HC0. The low byte of the word contains ERROR_NUMBER of HC0. These parameters can be used to checkout the appliance state.

Appliance / HC state	Not communicating	Ok	Error
STATE	= 0x00	<> 0x00	<> 0x00
ERROR_NUMBER	= 0x00	= 0xFF	<> 0xFF

For a more detailed description of defined HC states and error numbers please refer to the HC installation and operating instructions.

A HC may be reset (only) when it is in error. When, for example HC3 is in error, it can be reset by writing 0x4000 to the 'Reset & R/W control' holding register (0x003E) of the Modbus interface. The MI then sends a reset command to HC3 over the Argus Link bus. Once it has done this, it resets the high byte of the 'Reset & R/W control' register of HC3 (0x003E).

Lock out errors(manualy resettable)

Internal Code	Description	Display	
0	E2PROM_READ_ERROR	A0 E2	memmory error
1	IGNIT_ERROR	A1	No flame after ignition
2	FLOW_SENSOR_ERROR	A0	Not used
3	T_EXCHANGE_DIF_ERROR	A3	Temp difference between exchanger sensors 1 and 2
5	GV_RELAY_ERROR	A5	Error gasvalve relay on printboard
6	SAFETY_RELAY_ERROR	A6	Error safety relay on printboard
8	FAN_ERROR	A8	Speed burner fan not correct
9	RAM_ERROR	A0	memmory error
10	E2PROM_ERROR	A0	memmory error
11	T_FLOW_LOCK_ERROR	A2	Sensor exchanger 1 or 2 to hot
14	REGISTER_ERROR	A0	memmory error
15	FLAG_BYTE_INTEGRITY_ERROR	A0	memmory error
16	AD_HI_CPL_ERROR	A0	memmory error
17	AD_LO_CPL_ERROR	A0	memmory error
18	FLAMEROD_NEW_CPL_ERROR	A0	memmory error
19	STACK_ERROR	A0	memmory error (Stack overflow)
20	FLAME_OUT_TOO_LATE_ERROR	A7	Flame detection after closing gasvalve
21	FLAME_ERROR_1	A7	Flame detection before opening gasvalve
22	TOO_MANY_APS_ERRORS	A8	5 times switching Air Pressure Switch in 1 hour
24	TOO_MANY_FLAME_FAILURES	A4	3 times flame failure in 1 heating session
25	T_EXCHANGE_LOCK_ERROR A3		Exchange sensors defect.
26	APS_SWITCH_ERROR	A8	Air Pressure Switch Error.

Blokking errors(self resettable after error is gone)

Internal Code	Description	Display	
28	REFHI_TOO_LO_ERROR	E0	Temp difference between exchanger sensors 1 and 2
29	REFHI_TOO_HI_ERROR	E0	Temp difference between exchanger sensors 1 and 2
30	REFLO_TOO_LO_ERROR	E0	Temp difference between exchanger sensors 1 and 2
31	REFLO_TOO_HI_ERROR	E0	Temp difference between exchanger sensors 1 and 2
33	FLAME_ERROR_2	E0	Unexpected flame signal
35	T_EXCHANGE_BLOCK_ERROR	E1	Sensor exchanger 1 or 2 to hot
42	50HZ_ERROR	E0	Net Frequenty no 50Hz
44	WD_COMMUNICATION_ERROR	E0	Internal commication error.
78	APPLIANCE_SELECTION_ERROR	E2	Wrong Apliance selection resistance
79	POWER_SELECTION_ERROR E3		Wrong power selection resistance
80	RESET_BUTTON_ERROR	E9	Too manny times pressed on reset button in the heater

1.4 Controlling RC parameters.

Resetting of the RC is not possible. The 'Reset & R/W control' register of the RC (0x009E) has no reset function but instead it controls the reading and writing of the RC holding registers. Each bit of the 'Reset & R/W control' register corresponds with one parameter of the Read / Write holding registers table. When a bit in the 'Reset & R/W control' register is clear the data in the corresponding holding register byte is fetched from the RC into the MI. When a bit in the 'Reset & R/W control' register is set the data in the corresponding holding register byte is sent from the MI to the RC. To set a RC parameter through Modbus first set its bit in the 'Reset & R/W control' register. This stops the parameter being fetched from the RC. Then write the desired value into the parameters holding register. The following table lists the 'Reset & R/W control' bits and corresponding parameters

Reset & R/W control bits (bit clear = Get Parameter / bit set = Set parameter)				
R/W control register	bit	RC Parameter name	byte	Holding register
0x009E Low byte	0	ROOM_SETPOINT_DAY	0	0x0090 High byte
0x009E Low byte	1	ROOM_SETPOINT_NIGHT	1	0x0090 Low byte
0x009E Low byte	2	ROOM_SETPOINT_FROST	2	0x0092 High byte
0x009E Low byte	3	ROOM_SETPOINT_OFFSET	3	0x0092 Low byte
0x009E Low byte	4	ROOM_TEMP_CORR_HI	4	0x0094 High byte
0x009E Low byte	5	ROOM_TEMP_CORR_LO	5	0x0094 Low byte
0x009E Low byte	6	SUMMER_FAN	6	0x0096 High byte
0x009E Low byte	7	HEATING_PROGRAM	7	0x0096 Low byte
0x009E High byte	8	OPTION	8	0x0098 High byte
0x009E High byte	9	*Not used*		
0x009E High byte	10	*Not used*		
0x009E High byte	11	*Not used*		
0x009E High byte	12	*Not used*		
0x009E High byte	13	*Not used*		
0x009E High byte	14	*Not used*		
0x009E High byte	15	*Not used*		

The SUMMER_FAN byte can be used to readout or select one of the modes listed in the table below;

SUMMER_FAN (Holding register 0x0096 high byte)		
value	Summer Ventilation mode	Remarks
0x00	*undefined*	Do not use
0x01	cSF_OFF	Summer Ventilation off
0x02	cSF_1	Summer Ventilation at SUMMER_FAN_SPD_1 speed
0x03	cSF_2	Summer Ventilation at SUMMER_FAN_SPD_2 speed
0x04	cSF_3	Summer Ventilation at SUMMER_FAN_SPD_3 speed
0x00	*undefined*	Do not use

The HEATING_PROGRAM byte can be used to readout or select one of the modes listed in the table below;

HEATING_PROGRAM (Holding register 0x0096 low byte)		
value	Heating program mode	Remarks
0x00	cHP_USER	This mode is active when the user has changed the set point using the RC + and/or - buttons
0x01	cHP_OFF	Mode used for testing purposes only
0x02	cHP_FROST	Room temperature modulated to ROOM_SETPOINT_FROST
0x03	cHP_NIGHT	Room temperature modulated to ROOM_SETPOINT_NIGHT
0x04	cHP_DAY	Room temperature modulated to ROOM_SETPOINT_DAY
0x05	cHP_CLOCK	Mode that modulates the room temperature to a set point determined by the RC clock program
0x06	cHP_CLOCK_CHANGED	This mode is active when in clock program mode and when the user has changed the set point using the RC + and/or - buttons
other	*Undefined*	Other values may lead to unpredictable behaviour, do not use them.

The OPTION byte contains bits that control the behaviour of the RC and the system it is connected to. It can be used to readout or select one or more of the modes listed in the table below;

OPTION (Holding register 0x0098 high byte)		
bit	Option	
0	opDELTAT_ENABLE	deltaT enabled when bit set
1	opINTEGRATE_ENABLE	I-factor enabled when bit set
2	opOPTIMALISATION_ENABLE	Optimisation enabled when bit set
3	opDELTAT2_ENABLE	Secondary deltaT enabled when bit set
4	opEXTERNAL_SENSOR	Use external room sensor in 166RT when bit set
5	opAVG_EXT_INT_SENSOR	Use both RC and RT sensors when bit set
6	opVIEW_MODE_ONLY	Select RC view mode when bit set
7	*undefined*	For future expansion of options, Do not set this bit

Please be advised that;

- The parameters that are written to the RC are all written to the RC RAM memory. In case the power to the RC is interrupted the RC will fallback to the settings stored in its e2prom. It is the responsibility of the Modbus controller check and / or re-fresh the desired settings at regular intervals.
- Set points are scaled within the range of -10 to 118 °C. To set a set point of 25°C a value of (25+10)*2 = 70 = 0x46 must be written.
- The default setting of all holding registers after powering up of the MI is 0x0000
- The option byte can be used to put the RC in view only mode or to select other system options. For more details refer to the HC and RC installation and operation instructions.
- After powering up the heating system it takes a while before all Argus link devices are online and thus before all Holding registers are filled with the correct, up to date data.

1.5 Interpreting parameter values.

Reading holding register 0x0012 returns T_CHIMNEY as an unsigned word value. Scaling of the temperature values depends on the type of temperature.

To read the chimney temperature from Argus Link device 102 issue a Modbus command to read holding register 0x0022 (one word). The resulting unsigned word T_CHIMNEY can then be used to calculate the chimney temperature as demonstrated by the following formula;

I) Chimney temperature[°C] = (T_CHIMNEY / 256) - 15

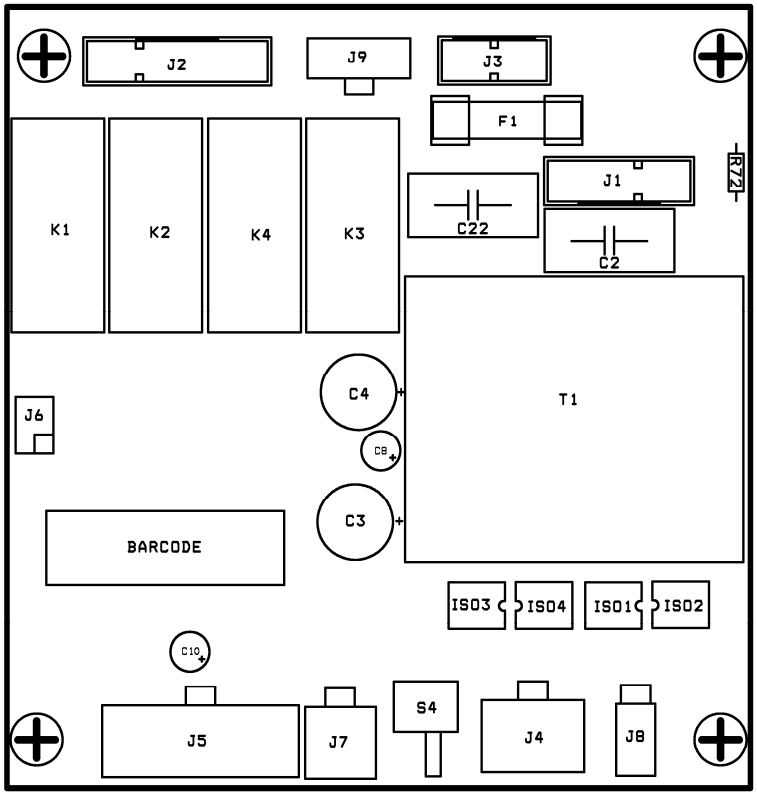
To read the ambient temperature from Argus Link device 107 issue a Modbus command to read holding register 0x0078 (one word). The resulting unsigned word T_AMBIENT can then be used to calculate the chimney temperature as demonstrated by the following formula;

II) Ambient temperature[°C] = (T_AMBIENT / 512) - 10

All other temperatures (including the room temperature registered by the RC) can be read / calculated in the same way as the ambient temperature (using formula II).

2 Connections to the interface board

In following PCB layout, the connectors and components are shown.



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PROJECT: 845IF_2		Approved by: HBe	
SCALE: 1:1	LAYER: Assembly TOP Reference(*.AST)	DATE: 22-01-2008	REV: -

Figure 1

The connectors are described below:

Connector	Pin	Pin Description
J1 *(Stelvio, BS95/3A + CT84)* *(Stocko, MKF 2800 series)*	1 2 3	Earth 230Vac neutral 230Vac phase
Mains input	The control is equipped with one fuse, in the phase. The fuse-holder is appropriate for glass fusses of 5x20 mm. The control is default equipped with one 3.15A slow fuse. This value may be lowered. The mains cable must be at least 3x0.75mm^2	

Connector	Pin	Pin Description
J2 *(Stelvio, BS95/4A + CT84)* *(Stocko, MKF 2800 series)*	1 2 3 4	Relay_1_3 Relay_1_5 Relay_2_3 Relay_2_5
Potential free N.O. outputs		

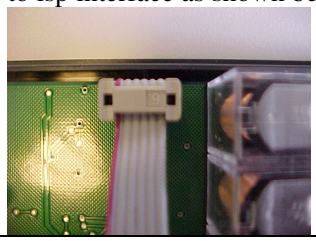
Connector	Pin	Pin Description
J3 *(Stelvio, BS95/2A + CT84)* *(Stocko, MKF 2800 series)*	1 2	Relay_3_5 230Vac neutral
Switched 230Vac N.O. output		

Connector	Pin	Pin Description
J4 *(Molex, Minifit Jr. 5557 2x3 receptacle with terminals 5556)*	1 2 3 4 5 6	Argus link 2_1 (Not used) Argus link 2_1 Vss Argus link 2_0 (Not used) Argus link 2_0 12V
Argus Link Connection		

Connector		Description
S4 *Switch*	On	Powers the Argus link bus on connector J4 Shown in Figure 1 is the off position of this switch.

Connector	Pin	Pin Description
J8 *(Molex, Minifit Jr. 5557 2x1 receptacle with terminals 5556)*	1 2	Argus link 1_1 (Not used) Argus link 1_0 (Not used)
Argus Link Connection		

Connector	Pin	Pin Description
J5 *(Molex, Minifit Jr. 5557 2x6 receptacle with terminals 5556)*	7-1 8-2 9-3 10-4 11-5 12-6	Switch input 0-10V in Sensor input 0-10V out 0-10V out Burner 0-10V out Pump
Sensor input		

Connector	Pin	Pin Description
J6		When programming connect **only** the Argus to isp interface as shown below; 
Processor Program Header		

Connector	Pin	Pin Description
J7 *(Molex, Minifit Jr. 5557 2x2 receptacle with terminals 5556)*	1 2 3 4	Modbus 1_A Modbus 2_A (Not yet implemented) Modbus 1_B Modbus 2_B (Not yet implemented)
Modbus		

Connector	Pin	Pin Description
J9 *(Molex, Minifit Jr. 5566 3 receptacle with terminals 5556)*	1 2 3	 230Vac neutral

3 Appendix

3.1 Argus link device details.

The Argus Link devices referred to in this document are;

- HC - Heating Control - 100…108
- HA - Heating control for atmospheric appliance - 100 …108
- RC - Remote Control, aka MTC Multi Therm Comfort - 1
- MI - Modbus Interface - 7

The IM software with software checksum [0C16] was designed to be used with;

- HC/HA units with checksum [C6D8]
- RC unit with checksum [445C]

You can use the LabVision ‘Checksum list’ to check the checksum of each device connected to Argus Link

3.2 LabVision support.

One project screen for Modbus device address setting and Modbus diagnose is available;