Corrigo E Ventilation

Modbus communication guide

Contains the most commonly used variables. Covers all versions of Corrigo E Ventilation from 3.1.

Revision: 2
Date: 19 August 2011

REGIN

THE CHALLENGER IN BUILDING AUTOMATION

Table of contents

Chapter 1 **Introduction**

Corrigo E ventilation

Corrigo E ventilation is a pre-programmed application for control of an air handling unit. The Corrigo E controller can either be used stand-alone or integrated in an existing EXO project, in both cases it is configured via the display or using the configuration tool E tool on a PC.

About this manual

This document gives you an introduction to communication via Modbus and provides you with a list of commonly used signals. The list is found in chapter 5.

A complete list of all signals accessible via Modbus and the EXOline protocol is found in the document *Corrigo E Ventilation variables* (accessible via the help menu in E tool).

This document does not describe how to create an EXO project or how to set up EXOline communication. For these matters, please refer to the EXO System and E tool manuals.

Signals

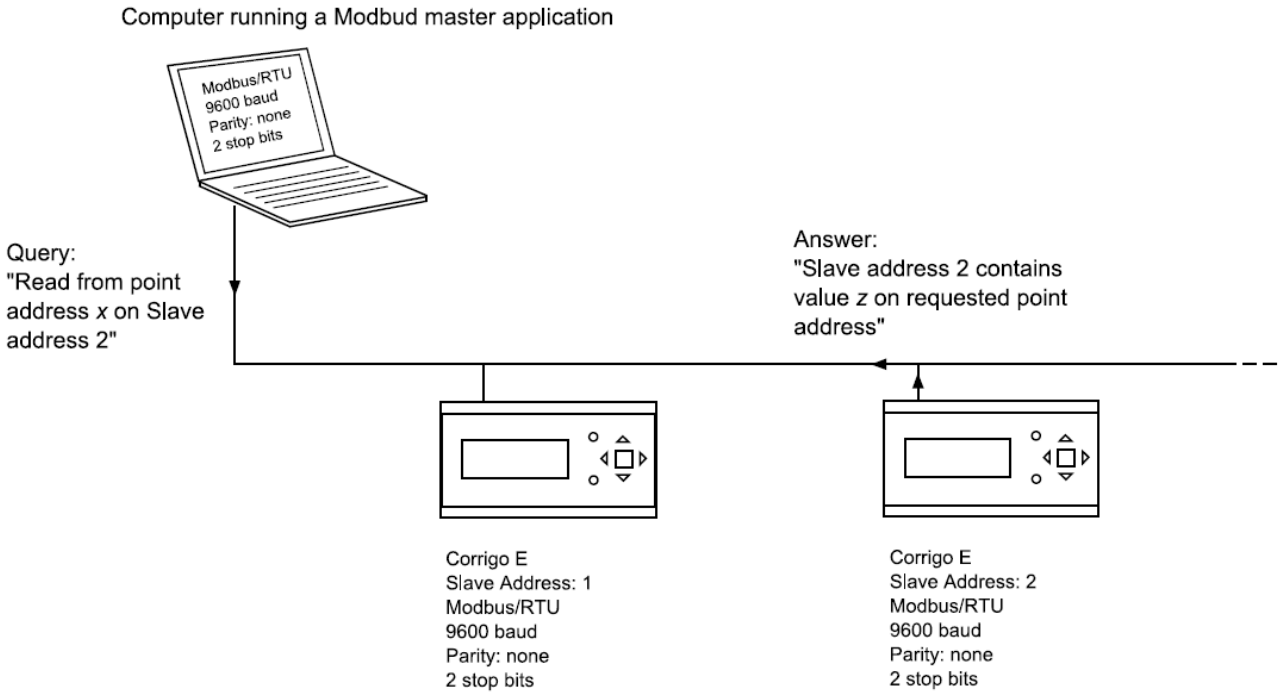
All signals described in this document are accessible from a SCADA/Modbus master system. The signals that have a default value are settings that can be changed; the signals without default values are actual values and cannot be changed.

Chapter 2 **Modbus communication**

General

A Modbus network consists of one master unit and one or more slave units. The Master controls the communication and requests information from the slave units. These are bound to answer in a certain manner depending on the request. The rules for communication are set up by the protocol. The Modbus protocol specification can be downloaded for free from the Modbus Organisation website www.modbus.com.

The simplified example below visualises the Master/Slave relation. In addition to the figure, checksums for message validation are also transmitted in both query and answer.



EXOL type

The Corrigo is programmed in the language EXOL, which has four different types of signals. These signal types are important to keep in mind since they decide what scale factor should be used to interpret the signal values. More about scale factors in chapter 3.

The EXOL types of the signals:

R = Real (-3.3E38 - 3.3E38)

I = Integer (-32768 - 32767)

X = Index (0 - 255)

L = Logic (0/1)

Modbus type

The Modbus types are not bound to the EXOL types. Therefore the list of common signals in chapter 5 contains both types.

The Modbus types of the signals (type in the list in chapter 5):

1 = Coil Status Register (Modbus function = 1, 5 and 15)

2 = Input Status Register (Modbus function = 2)

3 = Holding Register (Modbus function = 3, 6 and 16)

4 = Input Register (Modbus function = 4)

2 and 4 are *read-only*, while 1 and 3 are *read-write*.

Modbus functions

The Modbus master uses different Modbus functions in its query, depending on whether to read or write values. A function also describes what signal type it is meant for.

Supported Modbus functions:

1 = Read Coils

2 = Read Discrete Input

3 = Read Holding Register

4 = Read Input Register

5 = Write Single Coil

6 = Write Single Register

15 = Write Multiple Coils

16 = Write Multiple Registers

Max. 47 registers

Max. 47 registers can be read in one message.

Modbus wiring etc.

A protocol such as Modbus consists of several layers (OSI-model). The bottom layer is always the physical layer, number of wires and signal levels. The next layer describes the communication digits (number of data bits, stop-bits, parity etc.). After that come the layers describing the Modbus specific functions (number of digits per message, the meaning of different messages etc.).

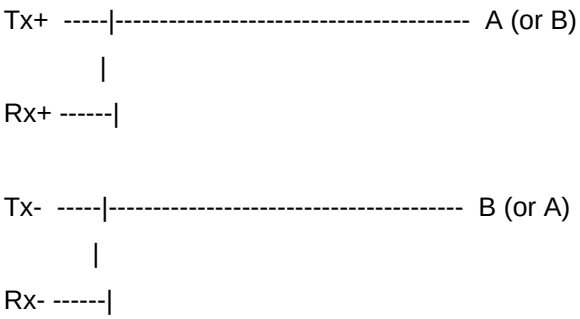
For Modbus, the bottom layer can be RS485, RS422 or RS232.

RS485 contra RS422

RS485 and RS422 are the electric part of the protocol, i.e. the physical layer. RS485 has two connections, A and B. Often there is also a protective ground (N on EXO controllers). RS485 units are always connected A → A and B → B. RS485 is so-called half duplex communication: Communication can only go in one direction at a time; i.e. the master will first send an enquiry and will thereafter listen for the reply. A and B are used for both transmission and reception.

RS422 is a full duplex communication which means that you need 4 wires, 2 for transmission (Tx+ and Tx-) and 2 for reception (Rx+ and Rx-). Tx is used to transmit and Rx to receive which means that Tx in one unit must be connected to Rx in the other and vice versa. As for signal levels etc., RS422 and RS485 are identical.

To interconnect RS485 and RS422, connect Tx+ with Rx+ and Tx- with Rx- on the RS422 unit. We have now changed a 4-wire system to a 2-wire system and can connect them to A and B on the RS485 unit. Which goes where is something you usually find out by trial and error. Incorrect polarity will just give non-function but cannot harm the units.



Bitrate, two stop bits, parity is the next layer

These settings must correspond to the settings in the master unit. Find out how the master is set and then give the Corrigo E the same settings.

Parity can be set to odd, even or none. If none is chosen you normally set two stop-bits instead but this is not necessary. If odd or even is chosen you can only have one stop-bit, otherwise there will be too many bits altogether: 1 start-bit, 8 data-bits, 1 parity-bit and 1 stop-bit give a total of 11 bits which is maximum.

Chapter 3 **Modbus and Corrigo E**

Communication limits The Modbus master must wait for a minimum of 3.5 charactertimes (4 ms at 9600 bps) between two messages. When the Modbus master communicates with more than one Corrigo E controller on the same communication line (RS485), the Modbus master must wait for a minimum of 14 charactertimes (16 ms at 9600 bps) between the answer and the first question for the next controller.

In the Corrigo E controller there is a limit of 10 fast communications in every half minute, the other communications will have a delayed answer of approximately 1 s.

Scale factor Modbus Real signals have scale factor 10 except the time settings signals that have scale factor 100 and air flow signals that have scale factor 1 for Modbus communication. Integer, Index and Logic always have scale factor 1.

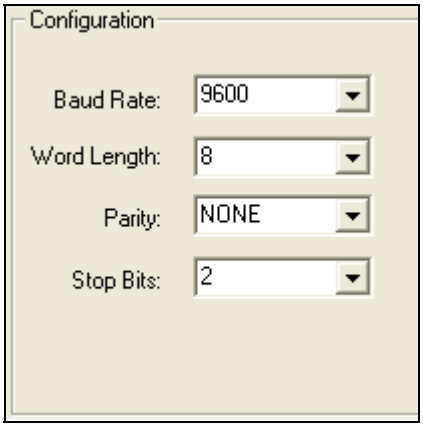
Modbus activation Corrigo E uses the same port for both Modbus communication and EXOline communication. If you try to communicate with a Modbus-activated unit using E tool or other EXOline communication, the input port will automatically adapt itself after approx. 1 s. The port will remain in EXO mode until 10 seconds of communication inactivity have passed, after which it will revert to Modbus mode.

Chapter 4 Setting up Modbus communication

Configuration

The first important thing to configure is the communication parameters for the Modbus line. As described earlier, these parameters must be identical in the master unit and the slave units, since they define the structure of messages and the transmission speed.

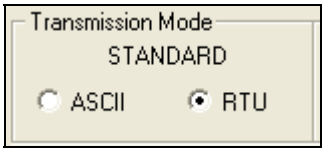
The default configuration values of a Corrigo E controller are shown in the figure below.



Corrigo E is by default set to Slave Address 1. If more units are added, a new Modbus address can be set for each unit using the Corrigo E display or E tool.

Transmission mode

Corrigo E uses the RTU transmission mode, not to be mixed up with the ASCII mode in the settings. The settings for the transmission mode must be the same in the master unit and the slave units, since Modbus/RTU cannot understand Modbus/ASCII messages. The configuration parameter *Word length* is always 8 for Modbus/RTU.

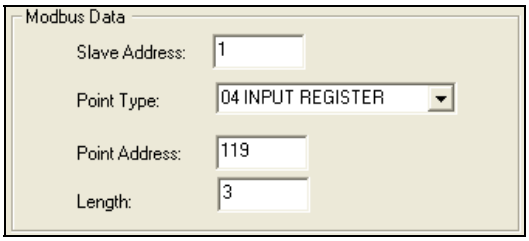


Writing values

To override the Corrigo E output values, set the output to manual mode using a Modbus signal. Then set the corresponding *..._ManSet* signal to the wanted level. These signals are listed in *Holding Registers.* In this document, all signals that are not listed in *Holding Registers* are *read-only.*

Reading values

An effective way to read values is to read multiple variables simultaneously. For example, to read the heating, exchanger and cooling levels, set the Modbus query to the values shown in the figure below. The heat output variable starts at address 119 (VentActual.Cor_HeatCV1(0)). To read address 119 to 121, set the length to 3. Then the Modbus answer will communicate all 3 values in just one message, making the communication more effective.



Chapter 5 **Commonly used signals**

To make system integration easier, a register of commonly used signals is provided below. Please refer to the document *Corrigo E Ventilation variables* for a complete list.

Input Status

Address	Variable name	Values	Description	EXOL type
1x0008	VentActual.Cor_ExtendedRunActiveFull	0/1	Set if extended operation full speed	Logic
1x0009	VentActual.Cor_ExtendedRunActiveHalf	0/1	Set if extended operation half speed	Logic
1x0033 … 1x0080	VentActual.Cor_AlaPt(1) … VentActual.Cor_AlaPt(48)	0/1 (1=Alarm)	Alarm points (see the Appendix) 1x0033 = Alarmpoint 1 … 1x0080 = Alarm point 48	Logic
1x0090 … 1x0128	VentActual.Cor_AlaPt(49) ... VentActual.Cor_AlaPt(87)	0/1 (1=Alarm)	Alarm points (see the Appendix) 1x0090 = Alarmpoint 49 … 1x0128 = Alarm point 87	Logic
1x0284	VentActual.Cor_UnitRunMode	0/1/2/3	Unit run mode: 0=Off 1=Reduced speed 2=Normal speed 3=Stop because of alarm	Index

Holding Register – Setpoint settings

Values for holding registers are adjustable (read/write).

Address	Variable name	Default value	Description	EXOL type
4x0001	VentSettings.Cor_SupplySetpoint	18°C	Setpoint supply air temperature when constant supply air temperature function	Real
4x0018	VentSettings.Cor_ExhaustSetpoint	21°C	Setpoint extract air temp. if extract air temp. control function	Real
4x0019	VentSettings.Cor_RoomSetP	21°C	Room setpoint if room temp. control function	Real
4x0024	VentSettings.Cor_SAFFullspeedPressure	500 Pa	Setpoint full speed supply air fan pressure	Real
4x0025	VentSettings.Cor_SAFHalfspeedPressure	250 Pa	Setpoint reduced speed supply air fan pressure	Real
4x0026	VentSettings.Cor_EAFFullspeedPressure	500 Pa	Setpoint full speed extract air fan pressure	Real
4x0027	VentSettings.Cor_EAFHalfspeedPressure	250 Pa	Setpoint reduced speed extract air fan pressure	Real
4x0028	VentSettings.Cor_SAFFullspeedAirFlow	2000 m3/h	Setpoint full speed supply air fan flow. Scale factor = 1	Real
4x0029	VentSettings.Cor_SAFHalfspeedAirFlow	1000 m3/h	Setpoint reduced speed supply air fan flow. Scale factor = 1	Real
4x0030	VentSettings.Cor_EAFFullspeedAirFlow	2000 m3/h	Setpoint full speed extract air fan flow. Scale factor = 1	Real
4x0031	VentSettings.Cor_EAFHalfspeedAirFlow	1000 m3/h	Setpoint reduced speed extract air fan flow. Scale factor = 1	Real
4x0392	VentActual.Cor_OutDoorTemp(0)		Outdoor temperature (Can be modified if not connected to a physic analogue input).	Real
4x0404	VentSettings.Cor_SupplySetpointMax	30°C	Max. limit of supply setpoint when cascade control	Real
4x0405	VentSettings.Cor_SupplySetpointMin	12°C	Min. limit of supply setpoint when cascade control	Real

Holding Register – Manual / Auto settings

Address	Variable name	Default value	Description	EXOL type
4x0368	VentSettings.Cor_AirUnitAutoMode	3	Running mode air unit: 0=Manual off 1=Manual reduced speed 2=Manual normal speed 3=Auto	Index
4x0369	VentSettings.Cor_SupplyPID_Select	2	Supply temp. controller mode: 0=Manual off 1=Manual on 2=Auto	Index
4x0370	VentSettings.Cor_SupplyPID_ManSet	0%	Supply temp. controller output if manual on mode	Real
4x0371	VentSettings.Cor_SAFAutoMode(0)	3	Running mode SAF: 0=Off 1=Manual half speed 2=Manual full speed 3=Auto	Index
4x0372	VentSettings.Cor_EAFAutoMode	3	Running mode EAF: 0=Off 1=Manual half speed 2=Manual full speed 3=Auto	Index
4x0373	VentSettings.Cor_SAFFrequenceAutoMode	3	Running mode frequency controlled SAF 0=Manual 1=Man. half speed 2=Man. Fullspeed 3=Auto	Index
4x0374	VentSettings.Cor_SAFManual	0 %	Frequency controller output SAF if manual mode	Real
4x0375	VentSettings.Cor_EAFFrequenceAutoMode	3	Running mode frequency controlled EAF 0=Manual 1=Man. half speed 2=Man. full speed 3=Auto	Index
4x0376	VentSettings.Cor_EAFManual	0 %	Frequency controller output EAF if manual mode	Real
4x0377	VentSettings.Cor_HeatCoilAutoMode(0)	2	Running mode Heating: 0=Off 1=Manual 2=Auto	Index
4x0378	VentSettings.Cor_HeatCoilManual(0)	0 %	Heating controller output if manual mode	Real

Address	Variable name	Default value	Description	EXOL type
4x0379	VentSettings.Cor_ExchCoilAutoMode	2	Running mode Exchanger: 0=Off 1=Manual 2=Auto	Index
4x0380	VentSettings.Cor_ExchCoilManual	0 %	Exchanger controller output if manual mode	Real
4x0381	VentSettings.Cor_CoolCoilAutoMode	2	Running mode Cooling: 0=Off 1=Manual 2=Auto	Index
4x0382	VentSettings.Cor_CoolCoilManual	0 %	Cooling controller output if manual mode	Real
4x0383	VentSettings.Cor_HumidityPID_Select	2	Running mode Humidification/Dehumidification: 0=Off 1=Manual 2=Auto	Index
4x0384	VentSettings.Cor_HumidityPID_ManSet	0 %	Humidification/Dehumidification controller output if manual mode	Real
4x0385	VentSettings.Cor_HeatPumpAutoMode(0)	2	Running mode P1-Heating: 0=Manual off 1=Manual on 2=Auto	Index
4x0386	VentSettings.Cor_ExchPumpAutoMode	2	Running mode P1-Exchanger: 0=Manual off 1=Manual on 2=Auto	Index
4x0387	VentSettings.Cor_CoolPumpAutoMode	2	Running mode P1-Cooling: 0=Manual off 1=Manual on 2=Auto	Index
4x0388	VentSettings.Cor_FireDamperAutoMode	2	Running mode fire damper: 0=Close 1=Open 2=Auto	Index
4x0451	VentSettings.Cor_ExternalControl	2	External control: 0=Extended run full speed 1=External stop 2=No external control 3=External stop with support control	Index

Input Registers

Values for input registers are read-only.

Address	Variable name	Description	EXOL type
3x0001	VentActual.Cor_OutDoorTemp(0)	Outdoor temperature	Real
3x0002	VentActual.Cor_Efficiency	Efficiency in % for exchanger	Real
3x0003	VentActual.Cor_RunMode	0=Stopped 1=Starting up 2=Starting reduced speed 3=Starting full speed 4=Starting normal run 5=Normal run 6=Support control heating 7=Support control cooling 8=CO2 run 9=Night cooling 10=Full speed stop 11=Stopping fan	Index
3x0007	VentActual.Cor_SupplyAirTemp	Supply air temperature	Real
3x0009	VentActual.Cor_ExhaustAirTemp	Extract air temp	Real
3x0010	VentActual.Cor_RoomTemp1	Room temperature 1	Real
3x0011	VentActual.Cor_RoomTemp2	Room temperature 2	Real
3x0013	VentActual.Cor_SAFPressure	Supply air fan pressure (Pa)	Real
3x0014	VentActual.Cor_EAFPressure	Extract air fan pressure (Pa)	Real
3x0015	VentActual.Cor_SAFAirFlow	Supply air fan flow (m3/h). Scale factor = 1.	Real
3x0016	VentActual.Cor_EAFAirFlow	Extract air fan flow (m3/h). Scale factor = 1.	Real
3x0017	VentActual.Cor_CO2Sensor	CO2 (ppm)	Real
3x0019	VentActual.Cor_FrostprotectionTemp	Frost protection temp	Real
3x0021	VentActual.Cor_DeIcingTemp	De-icing temp exchanger	Real
3x0023	VentActual.Cor_HumidityRoom	Humidity room	Real
3x0025	VentActual.Cor_ExtraSensor	Additional sensor / External setpoint	Real
3x0119	VentActual.Cor_HeatCV1(0)	Control signal heating Y1 (0-10 V)	Real
3x0120	VentActual.Cor_ExchCV1	Control signal exchanger Y2 (0-10 V)	Real
3x0121	VentActual.Cor_CoolCV1	Control signal cooler Y3 (0-10 V)	Real
3x0122	VentActual.Cor_SAF	Control signal supply air fan (0-10 V)	Real
3x0123	VentActual.Cor_EAF	Control signal extract air fan (0-10 V)	Real

Appendix **Alarm list**

No.	Alarm text	Prio	Description
1	Run Error Supply Air Fan	B	Malfunction Supply air fan
2	Run Error Extract Air Fan	B	Malfunction Extract air fan
3	Run Error P1-Heater	B	Malfunction pump, Heating circuit
4	Run Error P1-Cooler	B	Malfunction pump, Cooling circuit
5	Run Error P1-Exchanger	B	Malfunction pump, Liquid connected exchanger
6	Filter guard	B	Filter guard pressure switch activated
7	Flow guard	B	Flow guard activated
8	External frost guard	A	External Frost protection thermostat activated
9	Deicing pressure guard	-	Exchanger de-icing pressure switch activated
10	Fire alarm	A	Fire alarm activated
11	External switch	C	External switch activated
12	External alarm	B	External alarm activated
13	Supply Air control error	B	Supply air temp deviates too much from the setpoint for too long
14	Humidity control error	-	The room humidity deviates too much from the setpoint.
15	High supply air temp	B	Supply air temp too high
16	Low supply air temp	B	Supply air temp too low
17	Supply air temp max	-	Maximum limiting of supply air temp active
18	Supply air temp min	-	Minimum limiting of supply air temp active
19	High room temp	B	Room temp too high during room temp control
20	Low room temp	B	Room temp too low during room temp control
21	High extract air temp	B	High extract air temp during extract air control
22	Low extract air temp	B	Low extract air temp during extract air control
23	Electric heating is overheated	A	Heater high temperature limit switch activated
24	Frost risk	B	Frost protection function is overriding the control of the heater output
25	Low frostguard temp	A	Frost protection temperature below frost limit value
26	Low efficiency	B	Heat exchanger efficiency below limit value
27	Sensor error Outdoor temp	B	Malfunction of connected sensor
28	Analogue deicing	-	Exchanger de-icing activated by de-icing sensor
29	Rotation guard exchanger	B	Exchanger rotation sentinel alarm activated
30	Fire damper is out of operation	B	Fire damper exercise test failed
31	Supply Air Fan control error	-	Supply air pressure deviates too much from the setpoint for too long.
32	Extract Air Fan control error	-	Extract air pressure deviates too much from the setpoint for too long.
33	Supply Air Fan external operation	C	SAF run-signal received when unit is stopped
34	Extract Air Fan external operation	C	EAF run-signal received when unit is stopped
35	Ventilation Manual mode	C	The unit is shut down
36	Manual supply air control	C	Supply air temp controller in manual control

No.	Alarm text	Prio	Description
37	Manual supply Air Fan mode	C	Supply air fan in manual control
38	Freq. SAF Manual	C	Signal to SAF frequency converter in manual control
39	Manual Extract Air Fan mode	C	Extract air fan in manual control
40	Freq. EAF Manual	C	Signal to SAF frequency converter in manual control
41	Heating Manual Manual	C	Heating output in manual control
42	Manual exchanger control	C	Heat exchanger output in manual control
43	Manual cooler control	C	Cooling output in manual control
44	Manual P1-Heater	C	Heating circulation pump in manual control
45	Manual P1-Exchanger	C	Exchanger circulation pump in manual control
46	Manual P1-Cooler	C	Cooling circulation pump in manual control
47	Fire damp. Manual	C	Fire dampers in manual control
48	Internal battery error	A	Internal battery needs replacing
49	Sensor error Supply Air temp	B	Malfunction of connected sensor
50	Sensor error Extract Air temp	B	Malfunction of connected sensor
51	Sensor error Room temp 1	B	Malfunction of connected sensor
52	Sensor error Room temp 2	B	Malfunction of connected sensor
53	Sensor error Exhaust air temp	B	Malfunction of connected sensor
54	Sensor error Extra sensor	B	Malfunction of connected sensor
55	Sensor error SAF pressure	B	Malfunction of connected sensor
56	Sensor error EAF pressure	B	Malfunction of connected sensor
57	Sensor error Deicing temp	B	Malfunction of connected sensor
58	Sensor error Frost Protection temp	B	Malfunction of connected sensor
59	Sensor error CO2	B	Malfunction of connected sensor
60	Sensor error Humidity Room	B	Malfunction of connected sensor
61	Sensor error Humidity Duct	B	Malfunction of connected sensor
62	Sensor error Extra unit temp	B	Malfunction of connected sensor
63	Sensor error External control SAF	B	Malfunction of connected sensor
64	Sensor error External control EAF	B	Malfunction of connected sensor
65	Sensor error SAF Pressure 2	B	Malfunction of connected sensor
66	Sensor error Humidity outdoor	B	Malfunction of connected sensor
77	Alarm Frequency converter SAF	A	Malfunction of frequency converter SAF
78	Alarm Frequency converter EAF	A	Malfunction of frequency converter EAF
79	Communication error Frequency SAF	C	Communication problem with Vacon NXL
80	Communication error Frequency EAF	C	Communication problem with Vacon NXL
81	Communication error Expansion unit 1	C	Communication problem with a controller connected to port 2
82	Communication error Expansion unit 2	C	Communication problem with a controller connected to port 2
83	Warning Frequency converter SAF	C	
84	Warning Frequency converter EAF	C	
85	Output in manual mode	C	Analogue or digital output in manual mode
86	Time for service	C	Time for service
87	Manual Y4-Extra Sequence control	C	Y4-Extra sequence in manual control

AB Regin

Head office

Box 116, S-428 22 Kållered,
Sweden

Phone: +46 31 720 02 00
Fax: +46 31 720 02 50

info@regin.se
www.regin.se

Germany

RICCIUS + SOHN GmbH

Haynauer Str. 49
D-12249 Berlin

Phone: +49 30 77 99 40
info@riccius-sohn.eu
www.riccius-sohn.eu

France

Regin Controls SARL

32 rue Delizy
F-93500 Pantin

Phone: +33 1 41 71 00 34
info@regin.fr
www.regin.fr

Spain

Regin Ibérica, S.A.

C/Arganda 18 local
E-28005 Madrid

Phone: +34 91 473 27 65
info@regin.es
www.reginiberica.com

Singapore

**Regin Controls
Asia Pacific Pte Ltd**

66 Tannery Lane
03-04 Sindo Building
Singapore 347805

Phone: +65 6747 8233
info@regin.com.sg
www.regin.com.sg

Hong Kong

**Regin Controls
Hong Kong Ltd**

Room 2901
EW International Tower
120 Texaco Road
Tsuen Wan, NT
Hong Kong

Phone: +852 2407 0281
info@regin.com.hk
www.regin.com.hk