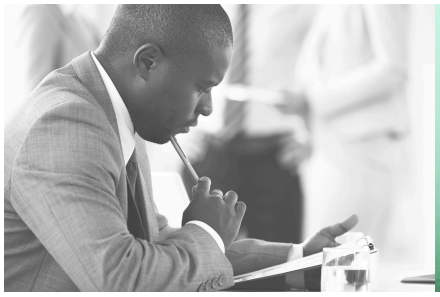

en

VARIABLE LIST

PDTX…-C

REGIN
THE CHALLENGER

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Rev. A, 2020-08-31

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Table of Contents

1 Presigo and Modbus communication

1.1 Introduction

Presigo PDTX…-C is a range of pressure transmitters equipped with one or two pressure sensors, two universal inputs, two universal outputs and an RS485 port for Modbus communication. It is especially well suited as distributed I/O modules for air handling unit controllers.

The transmitter operates as a Modbus slave, relieving the controller of up to two analogue pressure inputs, two universal inputs and two universal outputs. It is designed for easy installation together with Regin's Corrigo or EXOcompact controllers.

This document describes all signals that are accessible in the transmitter via Modbus.

1.2 Modbus

1.2.1 Type

The Modbus type of the signals:

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)

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

1.2.2 Communication limitations

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

The transmitter is limited to 10 fast communications every 30 seconds. Any other communications will have a delayed answer time of approximately 1 second.

A maximum of 47 registers can be read in one message.

1.2.3 Scale factor

The scale factors are shown in the register tables below.

1.2.4 Modbus via RS485

A protocol like Modbus consists of several layers (OSI-model). The bottom layer is always the physical layer; the number of wires and signal levels. The next layer describes the communication digits (number of data

bits, stop-bits, parity etc.). Next are the layers describing the Modbus-specific functions (number of digits per message, the meaning of different messages, etc.).

For Presigo, the bottom layer is RS485.

2 System integration using Modbus

2.1 Configuration

The communication parameters for the Modbus line are the most important thing to configure first. These parameters must be identical in both the master unit and slave units, since they define the structure of messages and the transmission speed.

The default configuration values of the Presigo are shown in the table below.

Table 2-1 Modbus factory settings

Description	Factory setting
Modbus address	1
Modbus setting	8 bytes, 1 stop bit, no parity
Modbus baud rate	9600 bps

The Modbus address in the transmitter is set to 1 as a default. If more units are added, a new address can be set for each unit in the *settings mode* menu using the joystick on each transmitter.

Note! The last configuration entered into the transmitter is always valid, regardless of whether it was performed using the menu system on the physical unit or via Modbus.

2.2 Reading values

An effective way to read values is to read multiple variables simultaneously. To, for example, read all analogue outputs, set the Modbus query to the addresses as shown in the table under chapter *6 Holding register*. The first analogue output variable starts at address 93 (`IO_ANAOUT_1`). To read address 93 to 94, set the length to 2. The Modbus answer will then communicate all 2 values in just one message, making the communication more effective.

2.3 Writing values

To write values via Modbus, set the corresponding Modbus signal to the wanted value. Values that are found in chapter *4 Coil status register* and *6 Holding register* are adjustable.

2.4 Modbus addressing

Modbus addresses are used in the variable lists. If your application needs Modbus register numbers the addresses have to be increased by 1.

3 Global device Status

The global device status is represented by the red LED. It is activated when one or several of the errors below occur. The actual status is read via the Modbus variable QPRODUCT_STATUS. The variable is a bit field where several errors can be active at the same time.

Table 3-1 Global device status list

Value	Description
[0x0000] 0	No active errors
[0x0001] 1	An unspecified error has occurred
[0x0002] 2	No sensor setup available for current model
[0x0004] 4	An issue has occurred with the zero-offset button driver
[0x0008] 8	An error occurred in the status LED driver configuration
[0x0010] 16	An error occurred in the HMI (BCD encoder, joystick or 7 segment display) driver configuration
[0x0020] 32	An error in universal input 1 configuration, or value out of range
[0x0040] 64	An error in universal input 2 configuration, or value out of range
[0x0080] 128	An error in pressure channel 1 configuration, or value out of range
[0x0100] 256	An error in pressure channel 2 configuration, or value out of range
[0x0200] 512	An error in flow channel 1 configuration, or value out of range
[0x0400] 1024	An error in flow channel 2 configuration, or value out of range
[0x0800] 2048	*Not used*
[0x1000] 4096	*Not used*
[0x2000] 8192	An error in universal output 1 configuration, or value out of range
[0x4000] 16384	An error in universal output 2 configuration, or value out of range
[0x8000] 32768	*Not used*

4 Coil status register

Signal name	Modbus address	Default value	Scale	Description
IO_DIGOUT_1	0	0	-	Digital output 1 Universal Output digital status Valid in digital mode only 0 = Open 1 = Closed
IO_DIGOUT_2	1	0	-	Digital output 2 Universal Output digital status Valid in digital mode only 0 = Open 1 = Closed

5 Input status register

Signal name	Modbus address	Default value	Scale	Description
IO_DIGIN_1	0	0	-	Digital input 1 Universal input digital status Valid in digital mode only 0 = Open 1 = Closed
IO_DIGIN_2	1	0	-	Digital input 2 Universal input digital status Valid in digital mode only 0 = Open 1 = Closed

6 Holding register

Signal name	Modbus address	Default value	Scale	Description
QPRODUCT_BAUD	0	0	-	RS485 port baud rate 0 = 9600 bits/s 2 = 2400 bits/s 3 = 1200 bits/s 15 = 19200 bits/s 17 = 38400 bits/s 18 = 57600 bits/s
QPRODUCT_MODE	1	15	-	RS485 port mode/protocol 0 = Inactive 15 = Modbus slave
QPRODUCT_FORMAT	2	16	-	RS485 port format 16 = 8 bit, no parity, 1 stop bit 24 = 8 bit, no parity, 2 stop bits 48 = 8 bit, even parity, 1 stop bit 56 = 8 bit, even parity, 2 stop bits 112 = 8 bit, odd parity, 1 stop bit 120 = 8 bit, odd parity, 2 stop bits
QPRODUCT_MODBUSUNITID	3	1	-	Modbus unit ID
QPRODUCT_STATUS	4	0	-	Bit field, see *chapter 3 Global device Status*
QPRODUCT_PSA_K_FACTOR	5	5	-	K-factor for flow measurement, sensor 1 [5…700], see *Appendix A Calculation of fan unit air flow*
QPRODUCT_PSB_K_FACTOR	6	5	-	K-factor for flow measurement, sensor 2 [5…700], see *Appendix A Calculation of fan unit air flow*
IO_ANAINTYPE_1	7	9	-	Universal input 1, input mode: 0 = Disabled 1 = Pt1000, measurement unit range in °C 8 = Ni1000-01, measurement unit range in °C 9 = Voltage, measurement unit range in volt
IO_ANAINTYPE_2	8	9	-	Universal input 2, input mode: 0 = Disabled 1 = Pt1000, measurement unit range in °C 8 = Ni1000-01, measurement unit range in °C 9 = Voltage, measurement unit range in volt
IO_ANAINTYPE_3	9	128	-	Pressure sensor 1, input mode: 0 = Disabled 128 = Pressure sensor, measurement unit range in Pascal 129 = Pressure sensor, measurement unit range in millibar 130 = Pressure sensor, measurement unit range in millimeter water column, mmH_2O 131 = Pressure sensor, measurement unit range in inch water column, inH_2O
IO_ANAINTYPE_4	10	128	-	Pressure sensor 2, input mode: 0 = Disabled 128 = Pressure sensor, measurement unit range in Pascal 129 = Pressure sensor, measurement unit range in millibar 130 = Pressure sensor, measurement unit range in millimeter water column, mmH_2O 131 = Pressure sensor, measurement unit range in inch water column, inH_2O
IO_ANAINTYPE_5	11	132	-	Flow sensor 1, input mode: 0 = Disabled 132 = Flow sensor, measurement unit range in m^3 /h 133 = Flow sensor, measurement unit range in ft^3 /min 134 = Flow sensor, measurement unit range in l/s

Signal name	Modbus address	Default value	Scale	Description
IO_ANAINTYPE_6	12	132	-	Flow sensor 2, input mode: 0 = Disabled 132 = Flow sensor, measurement unit range in m^3 /h 133 = Flow sensor, measurement unit range in ft^3 /min 134 = Flow sensor, measurement unit range in l/s
IO_ANAINTYPE_7… O_ANAINTYPE_20	13…26	-	-	*Not used*
IO_ANAINOFFSET_1	27	0	10	Universal input 1 Sensor offset
IO_ANAINOFFSET_2	28	0	10	Universal input 2 Sensor offset
IO_ANAINOFFSET_3	29	0	100	Pressure sensor 1 Sensor offset
IO_ANAINOFFSET_4	30	0	100	Pressure sensor 2 Sensor offset
IO_ANAINOFFSET_5	31	0	100	Flow sensor 1 Sensor offset
IO_ANAINOFFSET_6	32	0	100	Flow sensor 2 Sensor offset
IO_ANAINOFFSET_7… IO_ANAINOFFSET_20	33…46	-	-	*Not used*
IO_ANAINSCALE_1	47	1	100	Universal input 1 Sensor scale factor
IO_ANAINSCALE_2	48	1	100	Universal input 2 Sensor scale factor
IO_ANAINSCALE_3	49	1	100	Pressure sensor 1 Sensor scale factor
IO_ANAINSCALE_4	50	1	100	Pressure sensor 2 Sensor scale factor
IO_ANAINSCALE_5	51	1	100	Flow sensor 1 Sensor scale factor
IO_ANAINSCALE_6	52	1	100	Flow sensor 2 Sensor scale factor
IO_ANAINSCALE_7… IO_ANAINSCALE_20	53…66	-	-	*Not used*
IO_ANAINFILTERTIME_1	67	0	10	Universal input 1 Electronic damping for input. Time, in 1/10 seconds, for final value to reach 63%. [0…1200]
IO_ANAINFILTERTIME_2	68	0	10	Universal input 2 Electronic damping for input. Time, in 1/10 seconds, for final value to reach 63%. [0…1200]
IO_ANAINFILTERTIME_3	69	0	10	Pressure sensor 1 Electronic damping for input. Time, in 1/10 seconds, for final value to reach 63%. [0…1200]
IO_ANAINFILTERTIME_4	70	0	10	Pressure sensor 2 Electronic damping for input. Time, in 1/10 seconds, for final value to reach 63%. [0…1200]
IO_ANAINFILTERTIME_5	71	0	10	Flow sensor 1 Electronic damping for input. Time, in 1/10 seconds, for final value to reach 63%. [0…1200]
IO_ANAINFILTERTIME_6	72	0	10	Flow sensor 2 Electronic damping for input. Time, in 1/10 seconds, for final value to reach 63%. [0…1200]
IO_ANAINFILTERTIME_7… IO_ANAINFILTERTIME_20	73…86	-	-	*Not used*
IO_ANAOUTMODE_1	87	3	-	Analog output 1, Output mode 0 = Logic level – potential free input contacts (LOGIC) 3 = 0.0…10.0 V (0_10V)

Signal name	Modbus address	Default value	Scale	Description
IO_ANAOUTMODE_2	88	3	-	Analog output 2, Output mode 0 = Logic level – potential free input contacts (LOGIC) 3 = 0.0…10.0 V (0_10V)
IO_ANAOUTOFFSET_1	89	0	10	Analog output 1 Output offset
IO_ANAOUTOFFSET_2	90	0	10	Analog output 2 Output offset
IO_ANAOUTSCALE_1	91	1	100	Analog output 1 Output scale factor
IO_ANAOUTSCALE_2	92	1	100	Analog output 2 Output scale factor
IO_ANAOUT_1	93	0	10	Analog output 1 Output voltage, in 1/10 percent of 10V, only valid in analog mode
IO_ANAOUT_2	94	0	10	Analog output 2 Output voltage, in 1/10 percent of 10V, only valid in analog mode

7 Input register

Signal name	Modbus address	Default value	Scale	Description
QSYSTEM_MODEL	0	1350	-	Model number [1300…1399]
QSYSTEM_SVNVERSION	1	0	-	Internal revision number
QCOM_BAUDPORT1	2	0	-	Active RS485 port baud rate 0 = 9600 bits/s 2 = 2400 bits/s 3 = 1200 bits/s 15 = 19200 bits/s 17 = 38400 bits/s 18 = 57600 bits/s
QCOM_MODEPORT1	3	15	-	Active RS485 port mode/protocol 0 = Inactive 15 = Modbus slave
QCOM_FORMATPORT1	4	16	-	Active RS485 port format 16 = 8 bit, no parity, 1 stop bit 24 = 8 bit, no parity, 2 stop bits 48 = 8 bit, even parity, 1 stop bit 56 = 8 bit, even parity, 2 stop bits 112 = 8 bit, odd parity, 1 stop bit 120 = 8 bit, odd parity, 2 stop bits
QSERVICES_MODBUSUNITID	5	1	-	Active Modbus unit ID
IO_ANAIN_1	6	0	10	Universal input 1 (2 registers/channel) Measured value, depends on mode.
IO_ANAIN_2	8	0	10	Universal input 2 (2 registers/channel) Measured value, depends on mode.
IO_ANAIN_3	10	0	100	Pressure sensor 1 (2 registers/channel) Measured value, depends on mode.
IO_ANAIN_4	12	0	100	Pressure sensor 2 (2 registers/channel) Measured value, depends on mode.
IO_ANAIN_5	14	0	100	Flow sensor 1 (2 registers/channel) Measured value, depends on mode.
IO_ANAIN_6	16	0	100	Flow sensor 2 (2 registers/channel) Measured value, depends on mode.
IO_ANAIN_7… IO_ANAIN_20	18…44	-	-	*Not used*
IO_ANAINRAW_1	46	0	1	Universal input 1 (2 registers/channel) Raw value from sensor
IO_ANAINRAW_2	48	0	1	Universal input 2 (2 registers/channel) Raw value from sensor
IO_ANAINRAW_3	50	0	1	Pressure sensor 1 (2 registers/channel) Raw value from sensor
IO_ANAINRAW_4	52	0	1	Pressure sensor 2 (2 registers/channel) Raw value from sensor
IO_ANAINRAW_5	54	0	1	Flow sensor 1 (2 registers/channel) Raw value from sensor
IO_ANAINRAW_6	56	0	1	Flow sensor 2 (2 registers/channel) Raw value from sensor
IO_ANAINRAW_7… IO_ANAINRAW_20	58…84	-	-	*Not used*
IO_ANAOUTRAW_1	86	0	1	Analog output 1 (2 registers/channel) Raw output value
IO_ANAOUTRAW_2	88	0	1	Analog output 2 (2 registers/channel) Raw output value

Appendix A Calculation of fan unit air flow

PDTX…-C can be set to calculate flow based on the measured differential pressure from the pressure sensors. In order to calculate flow, it is necessary to first know the pressure drop across the fan, the density of the medium (air), as well the fan's ability to move air.

K-factor and density

The ability of the fan to move air is specified by the K-factor. A large fan will displace more air than a small one. The flow will also be affected by air density. The density will, in turn, be affected by the air temperature.

Complete formula for flow calculation

The formula for flow calculation is:

$Q_v = K * \sqrt{(2/\rho)} * \sqrt{\Delta P_m}$ [m³/h]

where

- ✓ Q_v = Calculated air flow in m³/h
- ✓ K = K-factor that gives the flow in m³/h
- ✓ ρ = Air density at current temperature
- ✓ ΔP_m = The measured differential pressure in Pascal

Simplified formula used in the Presigo

As most air handling units operate near a certain temperature, the density can be assumed to be a fixed value since changes in air density are small in a limited temperature range. This results in a simplified formula for flow calculation:

$Q_v = K_{unit} * \sqrt{\Delta P_m}$ [m³/h]

where

- ✓ Q_v = Calculated air flow
- ✓ K_{unit} = K-factor that gives the flow in m³/h and includes the air density
- ✓ ΔP_m = the measured differential pressure in Pascal

The Presigo transmitter uses this simplified formula for the flow calculations. Therefore, the K-factor that is entered via the Modbus signal QPRODUCT_PSA_K_FACTOR, must include the air density.

The manufacturer of the air handling unit states the K-factor of a specific unit. Some manufacturers include the density in the K-factor and others do not. If the given K-factor does not include the density, it has to be multiplied with $\sqrt{(2/\rho)}$, as expressed in the complete formula, before it is entered into the Presigo.

The transmitter will use the pressure value in Pascal for calculations, thus it is important to always use a K-factor which gives the calculated value in m³/h. It is then possible to select the flow unit in which the results should be presented by setting the corresponding Modbus signals to the desired mode. Choose between displaying m³/h, l/s or feet³/min.

Appendix B Technical data

B.1 General data

Supply voltage	24 V AC/DC (21…27 V AC/DC)
Protection class	IP54
Power consumption	< 4 VA
Transformer power	4 VA RMS, min. transformer size 7.5 VA
Ambient humidity	0…95 % RH (non-condensing)
Ambient temperature	-25…+50 C
Storage temperature	-40…+70 C
Mounting	Wall
Connection, cable	Screw terminals max. 1.5 mm^2 (AWG 16)
Connection, pressure	Connection pipes for 6 mm tube, (+) connects to higher pressure, (-) to lower pressure
Working range, pressure	0…1250 / 0…2500 / 0…7500 Pa (factory setting) 0…12 / 0…25 / 0…75 mbar 0…127 / 0…254 / 0…764 mmH_2O 0…5 / 0…10 / 0…30 inH_2O
Working range, flow	0...65000 m^3/h (factory setting) 0...31000 l/s 0...65000 Ft^3/min
Cable gland	2 x M20 (cable diameter 5…12 mm) 1 x M16 (cable diameter 3.5…10 mm)
Max overvoltage	±18 V, on any terminal (not G and G0)
Electronic damping	0 s (0…120 s)
Accessories, included	Two pressure outlets (straight) and 2 m plastic tube. Art. no.: ANS-20
Calibration	Factory calibrated
Dimensions, external (WxHxD)	167x(~130)x46 mm
Weight (incl. packaging)	0.39 kg

B.2 Pressure data

Media	Air, non-combustible and non-aggressive gases
Response time	40 ms, depending on the electronic damping
Sensor element, pressure	Piezoresistive
Temperature dependency, pressure	Thermal effects: 1 (-25…+85 °C), Offset: ±0.5 % FSS, Span: ±1.0 % FSS
Accuracy, pressure	≤ 1 % full scale
Resolution	0,005 % of full scale
Warmup time	< 5 min
Annual deviation	±2 Pa (1250 Pa), ±4 Pa (2500 Pa), ±20 Pa (7500 Pa)
K-factor	5 (5…700)
Zero-point adjustment	By pressing a button, the output signal and the display adjusts to zero.

B.3 Universal inputs

Universal inputs (UI)	2
Configuration	AI (AI/DI), see specifications below

B.3.1 Configured as AI

Analogue inputs (AI)	0…10 V (0…10 V / PT1000 / Ni1000-01)
Accuracy	± 1 % (0…10 V) ± 0.5 K (PT1000/Ni1000-01)
Measuring range, temperature	-40…+60 °C

B.3.2 Configured as DI

Digital input (DI)	Potential-free contacts on / off (on = closed)
Output current	0.5 mA (max 2.5 V)

B.4 Universal outputs

Universal outputs (UO)	2
Configuration	AO (AO / DO), see specifications below

B.4.1 Configured as AO

Analogue outputs (AO)	0…10 V
Load impedance, 0...10 V	Min. 10 kΩ
Accuracy	± 1 %

B.4.2 Configured as DO

Configuration	Potential-free contacts on / off (on = closed)
Power output	Max. 2A (total UO1 + UO2)

B.5 Communication data

Communication ports	1
Port type	RS485
Port isolation	Non-isolated
Supported protocols	Modbus
Default protocol	Modbus
Communication speed	9600 bps (1200…56700)
Stop bits	1 (1 / 2)
Cable length	Max 100 m

Parity	None (even / odd / none)
Device ID	1

B.6 Material

Material, housing	Polycarbonate (PC)
Material, base	Polycarbonate (PC)
Material, cable gland	Polycarbonate (PC)

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