Control System Type ABS PCxp

Installation Manual

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1 General information

The PCx series is a Control system from Sulzer. It includes a control unit, PCx, expansion unit, PCxp and operator panel PCxop. The communication between the units is through a CAN-network.

PCx is a control unit that can measure and log data, receive and transmit alarms, control of water and sewage pump works, pumping pits and booster stations. The PCx has many built in functions for controller of pumps, measurements of flows, etc. PCx communicates with other units through two interfaces, RS232 and RS485. The PCx software is supporting the protocols COMLI and Modbus. Examples of units that can be connected to the RS232/485 port are telephone modem, GSM-modem and radio.

PCx can have up to seven expansion units, PCxp, attached. The amount of in- and outputs for the PCx, the PCxp and a full system is shown in the table below:

<table>
<thead>
<tr>
<th></th>
<th>PCx</th>
<th>PCxp</th>
<th>PCx and 7 PCxp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital inputs</td>
<td>16</td>
<td>16</td>
<td>128</td>
</tr>
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<td>Digital outputs</td>
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</tr>
<tr>
<td>Analogue inputs</td>
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<td>4</td>
<td>32</td>
</tr>
<tr>
<td>Analogue outputs</td>
<td>2</td>
<td>2</td>
<td>16</td>
</tr>
</tbody>
</table>

The PCxop is a permanent mounted operator panel. The communication and power supply to the units are through the CAN-bus.

The PCx can be configured by two different ways,

- From the operator panels, PCxop
- From a PC with the software AQUA PROG from Sulzer. The PC can be connected directly to the PCx or via GSM-/telephone modems.

2 Nomenclature

AI Analogue input.
AO Analogue output.
CAN Control Area Network, an interface for communication.
PCx The PCx series electrical control processor unit.
DI Digital input.
DO Digital output.
I/O In- and outputs, can be either analogue or digital.
PCxop permanent mounted operator panel.
RS232/485 communication interfaces
PCxp PCx series expansion unit for more I/O.
3 Mechanical installation of PCxp

The PCxp fits on a standard 35 mm DIN-rail. Mounted on a DIN-rail, the PCxp has a length of 143 mm and width of 74 mm and the depth of 53 mm, see figure 3.1.

![Figure 3.1: The dimensions of the PCxp when mounted on a 35 mm DIN-rail](image)

To avoid interference, it is recommended to have the PCx and the PCxp-units in a separate section when putting together a cabinet alternative in a separate metallic enclosure. If contactors and relays are put in the same cabinet as the PCx and PCxp, those should be put as far away as possible from the PCx, PCxp units and their signal cables.

Power cables to or from electrical motors or similar shall not be put in the same duct as the signal cables from PCx or PCxp.

4 Electric installation of PCxp

PCxp can be used in many applications. This chapter describes the most common cable wiring for the PCxp. The unit is equipped with transient and interference suppression components. When the unit is put in hazardous areas, external transient and lightning protection is recommended especially on the RS232/485-port.
4.1 Power supply

The plus pole from the power supply connects to terminal number 22 and the negative to terminal number 23.

The connection between the chassis of the PCxp and the chassis (ground) of the cabinet is from either terminal number 1 or 21 to the. Internally in the PCxp, the power supply is galvanic separated from ground.

4.1.1 Power supply and battery backup

The power supply and the backup battery should be connected as the figure above. To monitor the net power, a relay can be connected to a digital input on the PCxp to receive alarm about it.

To prevent ground currents is the system built on a single point ground. Therefore a connection should be made between the negative power from the power supply and ground for the whole system only on a single point, the best solution is near the power supply unit. The figure above is illustrating that. The use of external transient protection is important when the unit is installed in exposed stations and in environments with high transient levels should also a magnetic stabiliser be used for the power supply to computers and signal sensors.

4.2 Digital outputs

The PCxp has 8 digital voltage outputs. They are numbered with terminal number 3 to 10. The digital outputs have a common minus output, DO-, with the terminal number 2. The voltage output is equal as the power supply voltage to the PCx. Every digital output has one LED indicator, which is lit when the output is high. The LED indicators are numbered 1-8.

One single digital output can have a maximum current of 1 A.

The total current for the 8 outputs may not be more then 4 A.

When backup power is installed, it is recommended to have a separate power supply for operations to lengthen the time for the backup functions, see figure on the next page.
When installing a relay, the terminal number 3-10, depending on which output is used, is connected to the relay and the terminal number 2, DO-. The DO- is internally connected to V-.

When PCxp shall send digital signals to a PLC, it is DO 1-8 that should be connected. If both units do not have the same potential shall DO- be connected to the PLC V-.

A digital output can be configured as a power supply for a modem, see chapter 4.7.2

All loads that can induce currents, for example contactors, shall be connected through a RC-filter. Also all big power consumers shall be connected through relays as close to them as possible. Signal cables and power cables should be in separate cable channels to suppress interference.

### 4.3 Analogue Outputs

The PCxp has two analogue outputs with the precision of 14 bits (1 µA). The maximum load is 500 ohm at 12 V and 1100 ohm at 24 V. An example on installation is in the figure below.

Units with a minus output connected to ground, PLC1, can be connected directly to the output. When more units are used to the same output shall these be connected serially.

In the figure above is the PLC 2 not connected to the same ground as that the PCxp uses. To solve this problem, a passive galvanic isolator, GS/P, is connected between the PLC and PCxp.
4.4 Analogue inputs

The PCxp has 4 analogue inputs with a precision of 20 bits (0.025 µA)

The inputs have the terminal numbers 16-19. See figure below for examples on installations. The inputs may need a galvanic isolator when connecting units to it.

The PCxp can provide external sensors with power through terminal numbers 15 and 20.

Figure below is showing installations of sensors.

4.4.1 Installation of a 4-20 mA loop powered 2-wire sensor

To install a loop powered sensor, connect the positive power cable to the terminal number 15 and connect the signal cable to terminal number 16-19, depending on which input that shall be used.

4.4.2 Installation of a self powered sensor with a 0/4-20 mA signal

To install a sensor that have an external power supply, connect the signal cable to the terminal number 16-19, depending on which input that shall be used. Also connect a cable between the negative power supply cable and terminal number 20 to get the same ground potential for both the sensor and PCxp.

Observe that this is only for sensors that do not need to be galvanic isolated.

4.4.3 Installation of a galvanic isolator

When units are used together with the PCxp, there are sometimes needs for galvanic isolation between the units. To solve this problem, a galvanic isolator can be installed, an example is Sulzer’s passive galvanic isolator GS/P. listed below are the most common cases where it is needed.

External Sensors that not have the same ground potential as the PCxp.

Units that do not have its negative output connected to ground

Long distances between sensor and PCx.
4.4.4 Installation of a sensor (not loop powered)

When a sensor needs to be power supplied from the PCxp, connect the positive power cable from the sensor to the terminal number 15 and the negative cable to the terminal number 20. Connect the signal cable to the terminal number 16-19, depending on which input that shall be used.

4.5 Digital inputs

The PCxp has 16 digital voltage inputs with the terminal numbers 25-40. Each input has a LED indicator. The maximum signal level on the inputs is 34 V. The inputs are galvanic isolated from the rest of the PCxp, in other words the DI- is not internally connected to V-.

Signal cables that come from far situated sensors with long wirings should have a surge and transient protection.

The figure below shows how the digital inputs should be connected if galvanic isolation is required.

**NOTE:** DI- must be connected to the negative cable.

When galvanic isolation is not required should the units be connected as figure below.

**NOTE:**

24, DI- must be connected to V- for the PCxp and the units that are connected to DI.
4.5.1 Installation of a relay switch

When a relay switch is used, connect it to V+ and terminal number 25-40, depending on which input shall be used.

4.5.2 Installation of a digital signal from a PLC.

When a PLC shall send digital signals to the PCxp, connect the signal cable to the input that shall be used. See note in the figures above about the DI-.

4.5.3 Installation of a sensor with an open collector output type PNP

When a sensor with an open collector output type PNP is used, shall the signal cable be connected to the terminal number 25-40, depending on which input shall be used. The positive power cable to V+ and the negative to terminal number 24, DI-.

Note: A sensor with an output type NPN cannot be connected directly to the PCxp, but can be connected to a relay switch which then can be used for the signal.

4.6 Installation of the CAN bus

The terminals for the CAN-bus are located to the left on the PCxp. The cable for the CAN-bus depends on application but the colour standard is the same as the table below.

<table>
<thead>
<tr>
<th>Terminal number</th>
<th>Cable Colour</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>41, 0V</td>
<td>Green</td>
<td>Common</td>
</tr>
<tr>
<td>42, CAN_L</td>
<td>White</td>
<td>CAN low</td>
</tr>
<tr>
<td>43, CAN_SHLD</td>
<td>Shield</td>
<td>Cable shield</td>
</tr>
<tr>
<td>44, CAN_H</td>
<td>Braun</td>
<td>CAN High</td>
</tr>
<tr>
<td>45, CAN_V+</td>
<td>Yellow</td>
<td>Positive Power supply, (PCxop)</td>
</tr>
</tbody>
</table>

All units with CAN interface shall be connected in parallel. The maximum length of the CAN network is 250 meters. To the PCxp all Cables are connected. In the connection between PCxp units and the PCx unit are only CAN_L, CAN_H and the cable shield used. Shielded cable is always recommended. For more information about the CAN-switches see chapter 5.2.

4.7 RS232/RS485 port

PCxp can communicate with the protocols COMLI and Modbus via the interfaces RS232 and RS485. The PCxp has one port for either RS232 or RS485 the configuration is made in software.

4.7.1 RS485

When the PCxp is installed in a RS485 network is these rules applied:

- Positive RS485 cable is connected to terminal number 49 with description RS 485 +/RTS
- Negative RS485 cable is connected to terminal number 50 with description RS 485-/TX
- All connected units on the network shall be connected in parallel, in other words cable + to + and – to –.

The maximum length on the RS485 network depends on the Baud rate for the network. The table below is showing this

<table>
<thead>
<tr>
<th>Baud rate</th>
<th>Maximal length</th>
</tr>
</thead>
<tbody>
<tr>
<td>115 200 bit/s</td>
<td>600 meters</td>
</tr>
<tr>
<td>57 600 bit/s</td>
<td>1200 meters</td>
</tr>
</tbody>
</table>

The network shall have termination in both ends. In other words resistors for termination shall be put on the units that are placed at the end of the network, The PCxp has a switch for that see chapter RS 485 END TERMINATE.
The RS485 port is connected to earth potential and is intended to be used for connection between units in the same building. When there is a long distance between the units where the potential may differ, a galvanic isolated multi drop modem is recommended, for example Westermo TD48.

4.7.2 RS232

There are many devices and accessories that can be connected to the RS232 port.

Direct connection to a personal computer can be made with a cable, part no.43360094.

The contact on modems from different manufactures is not always the same, to solve this is there adapters and cables available. To install and to know which adapter to use see next page.

The software in the PCx has a built in function that can restart a modem that has been jammed. A digital output, DO 1-8 is used to control this. The function controls the power supply to the modem. Positive power cable from the modem is connected to the DO 1-8, and the negative power cable from the modem to the DO-.

**NOTE:** The voltage level to the modem is equal as the power supply voltage level to the PCx.
5 Indicators and settings on PCxp

The PCxp has 5 different switches and 9 different LED indicators. These are described in detail in this chapter.

5.1 LED indicators

1. Power, Green light, the PCxp is in normal mode.
2. CAN, Green light, the PCxp has found one or more units to communicate with on the CAN bus
   Flashing green light, the unit has not found other units on the CAN bus
   Flashing red light, the CAN ID is set wrong
3. ALARM, Red light if it is low power supply voltage level. 1, 2, 6 and 7 is also lit in that case.
4. 485-/TX, Red light, when data is transmitted to the RS485/232 port.
5. RX, Red light, when data is received from the RS485/232 port.
6. RS232, Green light, if the interface RS232 is set.
7. RS485, Green light, if the interface RS485 is set.
8. DI 1-16, Yellow light, if the input is set, otherwise it is off
9. DO 1-8, Yellow light, if the output is set, otherwise it is off
5.2  Switches

5.2.1  CAN ID

In a CAN network must every unit have a unique address or ID-Number. On the PCx this is set by two switches. It is a hexadecimal number, when wrong ID is set the CAN LED is flashing red. The table is showing the ID-numbers that every unit should have.

<table>
<thead>
<tr>
<th>Unit</th>
<th>CAN ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCx</td>
<td>01</td>
</tr>
<tr>
<td>PCxp</td>
<td>02 – 08</td>
</tr>
<tr>
<td>PCxop</td>
<td>16</td>
</tr>
</tbody>
</table>

5.2.2  CAN TERM

A CAN network is of the type multi drop, more units can be connected parallel to each other on the same cable. The units that are at the ends of the network must have a termination. To do this with the PCx the switch CAN TERM is set ON.

One example on a CAN network is shown in the figure below, in this case the CAN TERM is set ON on the PCx and the last PCxp unit. On the PCxp units between those two is the CAN term set OFF.

A CAN network with one PCx and 3 PCxp units
5.2.3 COM PARAM

This switch has the function to set fix values to the parameters for the communications ports, CAN and RS232/485. This can be used when the unit is not responding correctly and shall only be used in that purpose to change the software parameters to correct values. When the COM PARAM switch is set to SW, the parameters that are in the software are used for the communications ports. When the COM PARAM switch is set to FIX, are the parameters fix and are these: CAN 250 Kbit/s, The RS232/485 port is set on RS232, 9600 bit/s, no parity.

5.2.4 RS 485 END TERMINATE

RS485-network is of same type as CAN, multi drop. This means also that resistors for termination must be at both ends. This switch is used for that purpose. If the switch is set ON is there a termination at the unit and if set OFF it is not.

An example on the placement of the termination is shown in the figure below.

NOTE: This switch shall be set OFF if RS232 is used
6   Technical data for the PCxp

The PCxp has the following data:

CPU type:   Philips XA-C3
Clock frequency:  32 MHz
Power supply:  9-34 VDC
Max currents: < 210 mA at 24 VDC (Every in and output are active and without any external loads on outputs and inputs)
            < 270 mA at 12 VDC ((Every in and output are active and without any external loads on outputs and inputs)
Min currents:  < 60 mA at 24 VDC
               < 100 mA at 12 VDC
Installation: 35 mm DIN-rail
Dimensions:  143 x 74 x 53 mm (W x H x D)
Digital outputs:  8
Maximum load 1 A/output and the total current for all 8 outputs is maximum 4 A
Digital inputs:  16
Input resistance: 10 kohm
Trig level:  4.2 V
Analogues outputs:  2
Maximum load:  500 ohm at 12V, 1100 ohm at 24V
Resolution:  14 bits 1 µA
Current limit:  22 mA
Analogues inputs:  4
Resolution:  20 bits 0,025 µA
Inaccuracy:  less than 0.1% of FS
Temperature deviation: less than 0.2% of FS in the temp. range -20 to 70 °C

CAN ports:  1
Max baud rate: 512 kBaud
RS232/485 port:  1
Max baud rate: 115200 baud
Ambient temperature:  -20 – 70 °C
## 7 Accessories and part numbers.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part no.</th>
<th>Note.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCx GB</td>
<td>15100015</td>
<td></td>
</tr>
<tr>
<td>Installation manual PCx GB</td>
<td>81300040</td>
<td></td>
</tr>
<tr>
<td>PCxp</td>
<td>15000002</td>
<td>Expansion module</td>
</tr>
<tr>
<td>Installation manual PCxp GB</td>
<td>81300042</td>
<td></td>
</tr>
<tr>
<td>PCxop Panel GB</td>
<td>15000006</td>
<td></td>
</tr>
<tr>
<td>Installation manual PCxop GB</td>
<td>81300044</td>
<td></td>
</tr>
<tr>
<td>CAN-cable per meter</td>
<td>43320586</td>
<td></td>
</tr>
<tr>
<td>CAN-cable 3 m</td>
<td>43360096</td>
<td></td>
</tr>
<tr>
<td>PC-cable</td>
<td>43360094</td>
<td>9-pole D-contact – 5-pole Phoenix contact, Length 2 m.</td>
</tr>
<tr>
<td>System manual for PCx GB</td>
<td>81300046</td>
<td></td>
</tr>
<tr>
<td>COMLI/Modbus-Manual GB</td>
<td>81300048</td>
<td></td>
</tr>
<tr>
<td>Power supply 27,2 V/1,2 A dc</td>
<td>28000000</td>
<td>Without socket</td>
</tr>
<tr>
<td>11-pole socket</td>
<td>43190000</td>
<td>For power supply</td>
</tr>
<tr>
<td>Battery 12 V/4 Ah</td>
<td>47000000</td>
<td>2 are needed</td>
</tr>
<tr>
<td>Battery case</td>
<td>39000041</td>
<td></td>
</tr>
<tr>
<td>AQUA PROG</td>
<td>71400006</td>
<td>PC-configuring program for PCx</td>
</tr>
</tbody>
</table>
Declaration of Conformity

As defined by: EMC Directive 2014/30/EU, RoHS II Directive 2011/65/EU

EN: Name and address of the person who is authorized to compile the technical file to the authorities on request:

DE: Name und Adresse der Person, die berechtigt ist, das technische Datenblatt den Behörden auf Anfrage zusammenzustellen:

FR: Nom et adresse de la personne autorisée pour réunir le fichier technique auprès des autorités sur demande :

NL: Naam en adres van de persoon die geautoriseerd is voor het op verzoek samenstellen van het technisch bestand:

ES: Nombre y dirección de la persona autorizada para compilar el archivo técnico destinado a las autoridades:

PT: Nome e endereço da pessoa autorizada a compilar o ficheiro técnico para as autoridades, caso solicitado:

IT: Il nome e l’indirizzo della persona autorizzata a compilare la documentazione tecnica per le autorità dietro richiesta:

EL: Όνομα και διεύθυνση του ατόμου που είναι εξουσιοδοτημένο για τη σύνταξη του τεχνικού φακέλου προς της αρχής επί της απαίτησης:

TR: Tekil makam almak isteyen teknik dosyayı hazırlayabilme yetkili olan kimin adı ve adresi:

SV: Namn och adress på den person som är autoriserad att utarbeta den tekniska dokumentationen till myndigheterna:

NO: Navn og adresse på den personen som har tillatelse til å vise den tekniske dokumenten til myndighetene ved forespørsel:

DA: Erklærer på eget ansvar, at følgende produkter:

FR: Déclare sous notre exclusivité Responsabilité que les produits:

IT: Dichiaramo sotto la nostra esclusiva responsabilità che i prodotti:

EL: Επιβεβαιώνουμε με αποκλειστική μας ευθύνη ότι τα προϊόντα:

TR: Sorumluluk tanımam bize ait olarki beyan ederiz ki ağaç tadı ile alıcı ziyaret eden her과학적 uygunluk:

HU: Azonnal vám nyújtja a válasz gyakorlatban, amely személyes és más személyes dokumentumokkal járható:

PL: Nazwa i adres osoby upoważnionej do przygotowania dokumentacji technicznej w przypadku, gdy jest ona wymagana przez władze:

CS: Jméno a adresa osoby oprávněné na vyžádání ze strany úřadů vytištít soubor technické dokumentace:

SK: meno a adresa osoby oprávnenej na zostavenie technického súboru pre úrady na požiadanie:

FI: Tunniste vastaa asianomaisen viranomaisen pyyntössä saatavilla dokumentteja:

TR: Asmens, įgalioto valdžios institucijoms pareikalavus sudaryti techninę bylą, vardas, pavardė ir adresas:

HU: Alkalmazottak nevezetével, a megfelelőségi nyilatkozat aláírására vonatkozóan:

EN: which this declaration relates are in conformity with the following standards or other normative documents:

SV: Föräskrar under eget ansvar att produkterna:

NO: Erklærer under eget ansvar, at følgende produkter:

DA: Erklærer på eget ansvar, at følgende produkter:

FR: Déclarons sous notre exclusivité Responsabilité que les produits:

IT: Dichiariamo sotto la nostra esclusiva responsabilità che i prodotti:

EL: Επιβεβαιώνουμε με αποκλειστική μας ευθύνη ότι τα προϊόντα:

TR: Sorumluluk tanımam bize ait olarki beyan ederiz ki ağaç tadı ile alıcı ziyaret eden her과학적 uygunluk:

HU: Azonnal vám nyújtja a válasz gyakorlatban, amely személyes és más személyes dokumentumokkal járható:

IT: Ogni volta che si verifichi il caso d'eccezione, si riconoscerà l'effetto del presente atto:

PL: Każda decyzja dotycząca zmian w regulacjach dotyczy:

CS: Každá autorizace na vyprovokování produktu:

SK: Nenapísal, že mám autoritu na vykonávanie:

FI: Tämän säännösten ja muun säännöksen mukaisuus:

TR: İlgili kurumdan onaylanmasa, belgelere uygunluk:

HU: Azonnal vám nyújtja a válasz gyakorlatban, amely személyes és más személyes dokumentumokkal járható:

EN: System control type ABS PCx

EMC: EN 61326-1:2013

Stockholm 2017-06-28

Per Askenström
Sulzer Pumps Sweden AB