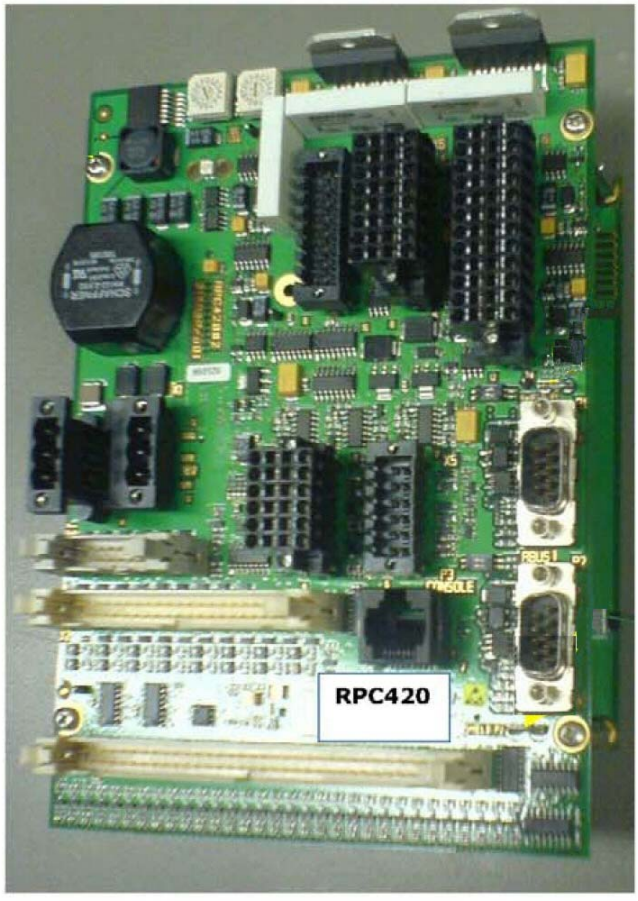
RPC420

Hardware Module Description

Kongsberg Maritime Part no. 317114



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Comments

To assist us in making improvements to the product and to this manual, we welcome comments and constructive criticism.
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KONGSBERG

Table of contents

Glossary

AI	Analogue Input
AO	Analogue Output
AOB	Analogue Output Bitcoded
COM	Common
DI	Digital Input
DO	Digital Output
ESD	Electrostatic Discharge
GND	Ground (Module 0 V reference)
Hex	Hexadecimal
HSD	High Side Driver
IE	Instrumentation Earth
I/O	Input/Output
KM	Kongsberg Maritime
LED	Light Emitting Diode
LP	Loop Power
Mbps	Megabits per second
MUX	Multiplexer
MTBF	Mean Time Between Failure
NO	Normal Open
NC	Normal Closed
PE	Protective Earth
PWM	Pulse Width Modulation
RBUS	Remote Serial Process Bus
RCU	Remote Controller Unit
RIO	Remote I/O
RPC420	Remote Panel Controller series 420
WD	Watchdog

1 OVERVIEW

The RPC420 is an interface-module between panels on one side and RCU(s) on the other side.

Features of the RPC420:

- Interface for levers
- Interface for LEDs
- Interface for buttons
- Interface for instruments (meters)
- Functions for dimming lamps and lamp test
- Interface for panel backlight
- Three internal buzzers and HSD for activating external buzzer
- Connection for redundant power supply
- Two serial process bus interfaces (RBUS A and RBUS B) for redundant communication to the RCU(s)
- Galvanically isolated RBUS interfaces
- Plug-in connections for fast replacement
- Two-digit address-switch for setting the module address
- Status LED on the front showing status (running or offline)

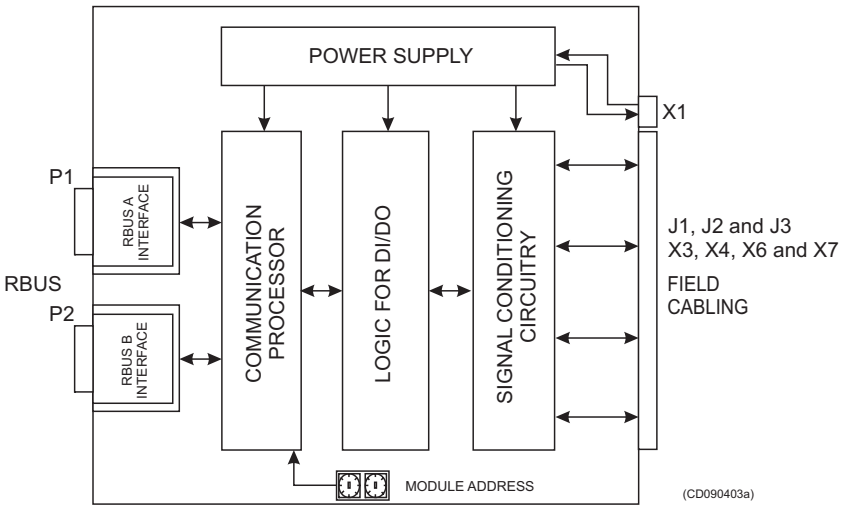
2 FUNCTION

The RPC420 is a stand-alone panel-interface module. The module comprises a piggyback design with two circuit boards (see *Component layout* on page 28 for layout details).

The module is used for interfacing dedicated digital and analog input and output signals from special control panels on one side and communicating with one/two RCU(s) via single/dual serial process bus (RBUS) on the other side.

The field connectors and terminal blocks on the module are configured with I/O channels that match the demand from different dedicated panel modules.

Figure 1 RPC420 block diagram



The RPC420 can be divided into the following main building blocks:

- Power supply
- RBUS interfaces
- Communication processor
- I/O with signal conditioning circuitry

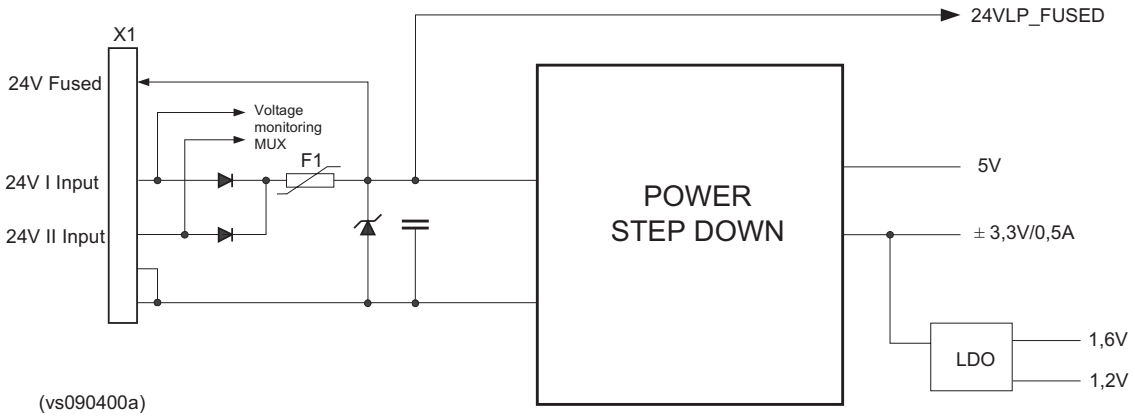
2.1 Power supply

The RPC420 is powered with 24 Vdc via the terminal block X1. Two power supplies can be connected to allow power redundancy. Diodes are provided to isolate the two power inputs from each other. Both voltage inputs are monitored by the RPC420 module.

To protect the power supply components and the module itself from over voltage and over current, an automatic fuse F1 (2.25 A) is connected in series and a tranzorber are connected in parallel on the input side. A fused 24 Vdc output terminal is provided for powering external equipment.

Five voltages are made locally on the module for internal use: 1.2 Vdc, 1.6 Vdc, ±3.3 Vdc and 5 Vdc (VCC).

Figure 2 Power supply principles



2.2 RBUS interface

Two multidrop RS485 serial lines are used. RBUS A and RBUS B are galvanic isolated from each other and from the I/O part of the module. Bit rate is 2 Mbps.

Manchester Coding is used in order to avoid timing problems and to reduce cabling cost.

The RBUS cable also supply power (24 V) to the isolated part of the RS485 line.

2.3 Status LED

A status LED is located under the address wheel (LSD). It is green when it is running in the host system and no error is detected. It is red otherwise. See also *Self diagnostics* on page 24 for more details.

2.4 Module address (Slot No.)

Each module must be set to a unique address (Slot No.) that identifies this module among the others connected to the RBUS. The module address is represented by two decimal switches:

- MSD (most significant digit)
- LSD (least significant digit)

The total number of modules allowed connected to one RBUS are 99 (slot number 1 through 99). The address setting (slot number) range is consequently a number between 01 and 99.

The slot number is compared with the RBUS address set out from the RCU. If they are equal, the module responds.

2.5 Digital output driver capability

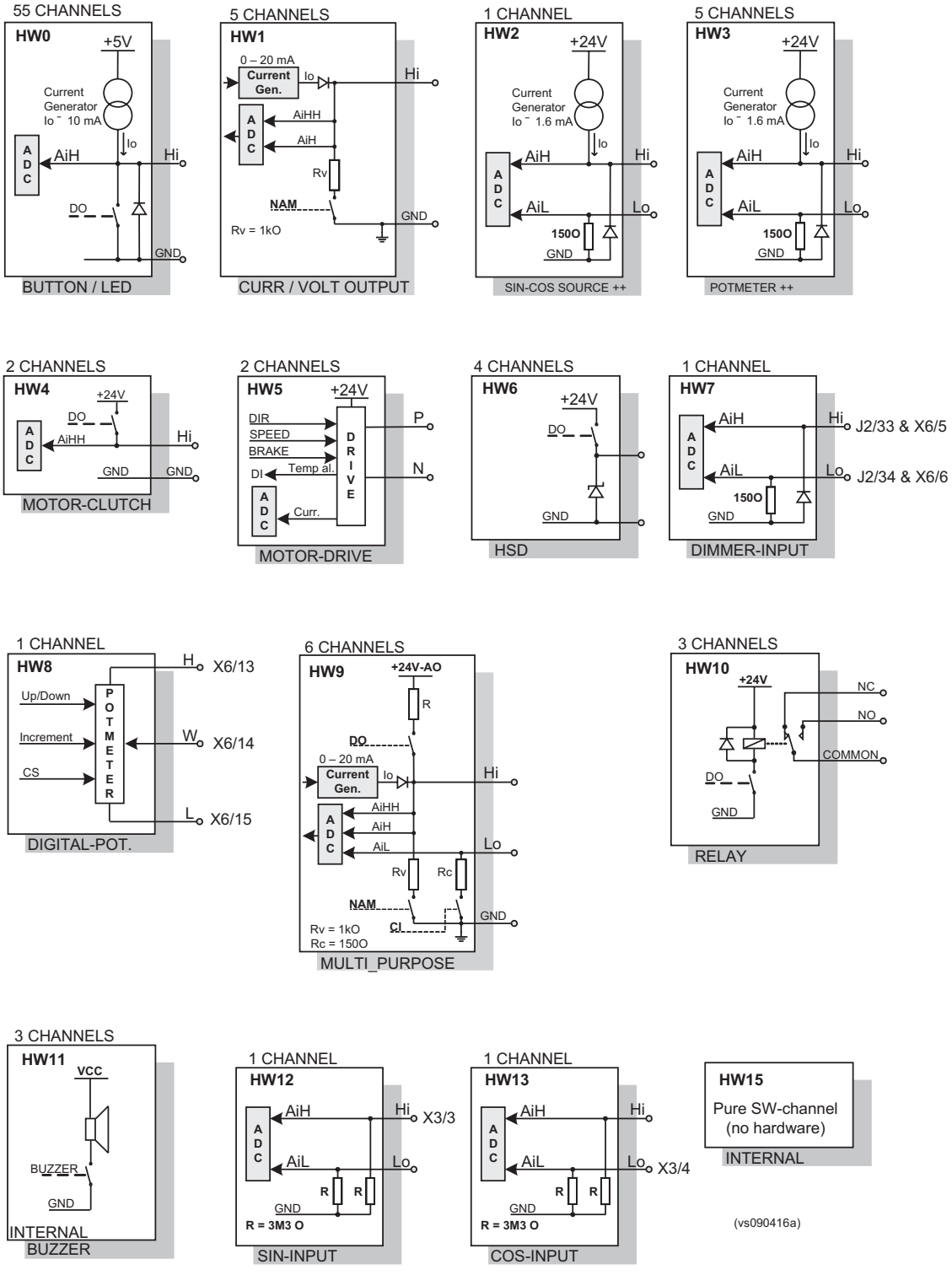
The RPC420 uses High Side Drivers (HSDs) for driving the 24 Vdc digital power output loops and motor-control loops, see also:

- *Motor clutch control with HSD (HW type 4)* on page 16
- *Motor drive control (HW type 5)* on page 17
- *Backlight Driver with HSD (HW type 6)* on page 18

The HSDs are designed for both resistive and inductive loads and offer short-circuit protection of the loop. At overload the High Side Driver (HSD) is switched off by a built-in temperature sensor. When the temperature falls below a certain limit, the output is turned on again. Thus the HSD output will pulse with a low frequency until the short circuit has been removed.

2.6 Hardware types (HW types) overview

There are several hardware types. These are described in the following sections.



2.7 DI/DO – button and LED driver (HW type 0)

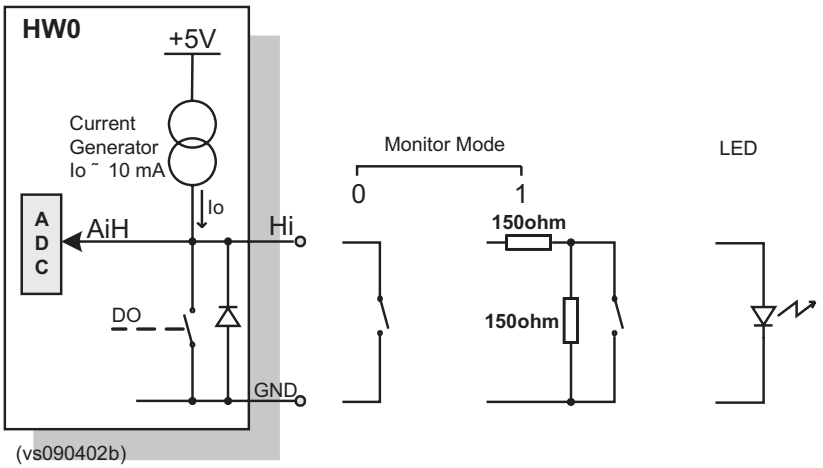
This interface type is used both for DI and DO.

DI is typically used for reading a button and is read as an analog voltage. DO is typically used for turning a LED on/off. The LED can be PWM (pulse width modulated) using the DO. In both cases a 10 mA constant current generator is used.

This interface type is implemented for the following channels:

SW channels	HW channels
1, 2 ,3, 4, 5 to 34, 65 to 85	1, 2, 3, 4, 5 to 10 to 42, 55, 56, 61 and 64 to 73

Figure 3 Loop typical information



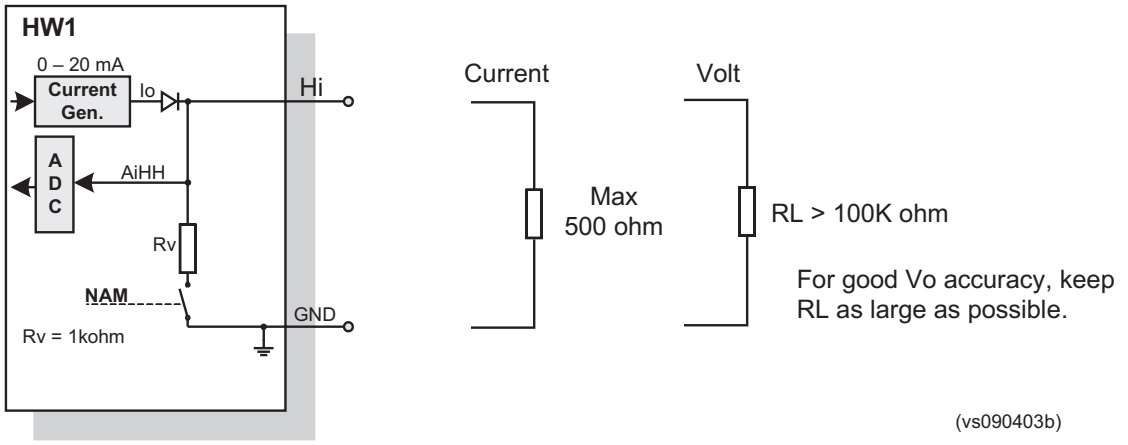
2.8 Current or voltage output for instruments (HW type 1)

This interface is used to drive meter instruments. Output can be presented as current (0 to 20 mA) or voltage (0 to 10V). When output voltage is selected, the voltage is generated by sending a calibrated current (0 to 10 mA) through the internal voltage resistor Rv (1 kOhm).

This interface type is implemented for the following channels:

SW channels	HW channels
39 to 42	57 to 60

Figure 4 Loop typical information



2.9 Sine/cosine potentiometer input (HW type 2)

The sine/cosine potentiometer require three SWchannels. Channel 44 is the power source for the sine/cosine potmeter, and will deliver a constant current (1.6mA) through the potentiometer and to GND via the internal 150 ohm resistor. The voltages on Hi and Lo is used to monitor the potmeter.

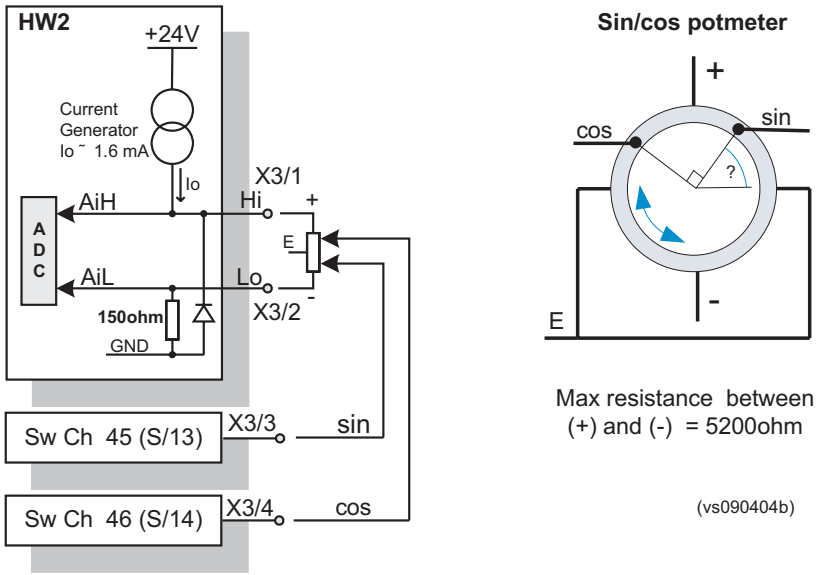
Maximum potentiometer resistant is 5000 ohm.

The sine/cosine voltages is read by SW channel 45 and 46 as shown below.

This interface type is implemented for the following channel:

SW channel	HW channel
44	43
45	44S
46	44C

Figure 5 Loop typical information



2.10 Single potentiometer input (HW type 3)

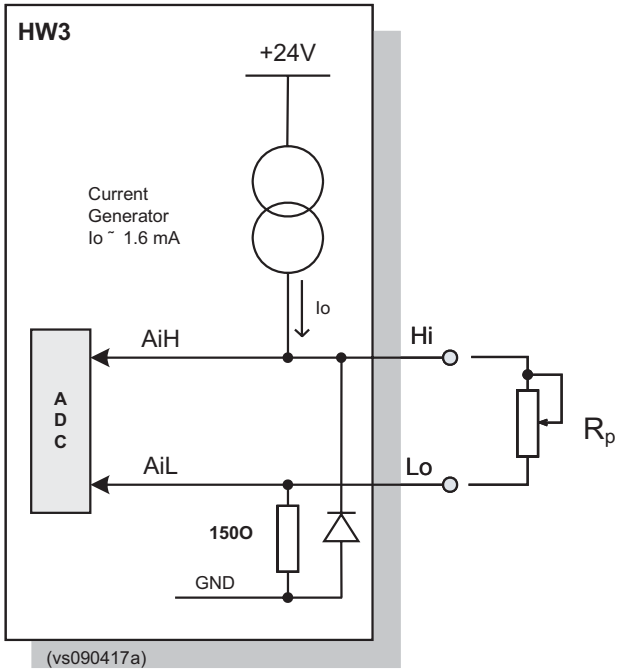
A constant current of approximately 1.6 mA is generated by this circuitry. The current passes through the connected potentiometer (R_p) and to GND via the internal 150 ohm resistor. The voltages on Hi and Lo is used to calculate the external resistance (Rp) and to monitor the potmeter.

Potmeter range 0 - 5702Ω.

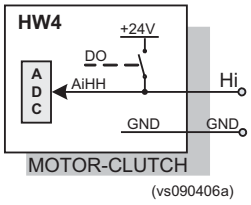
This interface type is implemented for the following channels:

SW channels	HW channels
43 and 47 to 50	63 and 45 to 48

Figure 6 Loop typical information



2.11 Motor clutch control with HSD (HW type 4)



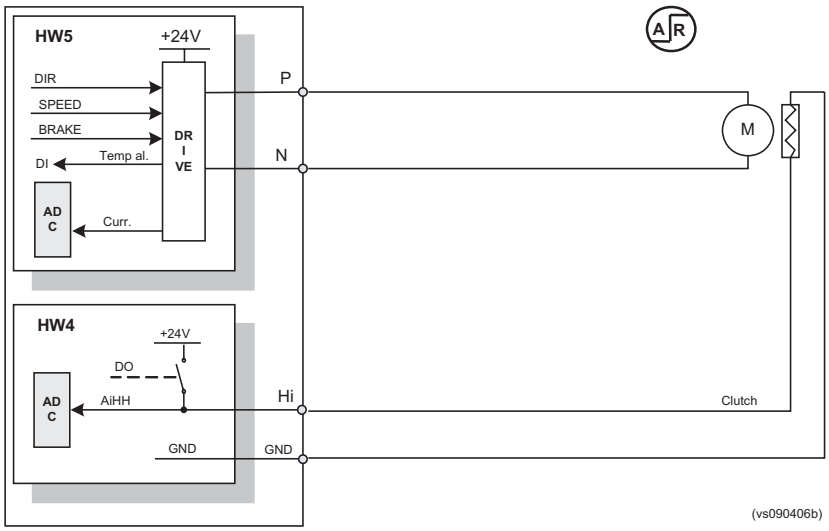
The interface type is made for motor clutch control.

Clutch operation is done by controlling the DO which activate or passivate the internal HSD accordingly.

This interface type is implemented for the following channels:

SW channels	HW channels
52 and 54	51 and 50

Figure 7 Loop typical information



2.12 Motor drive control (HW type 5)

The interface type is made for motor control. The speed and direction is controlled by the 16 bit AO-word as shown below.

DIR: selects rotation- direction CW or CCW.

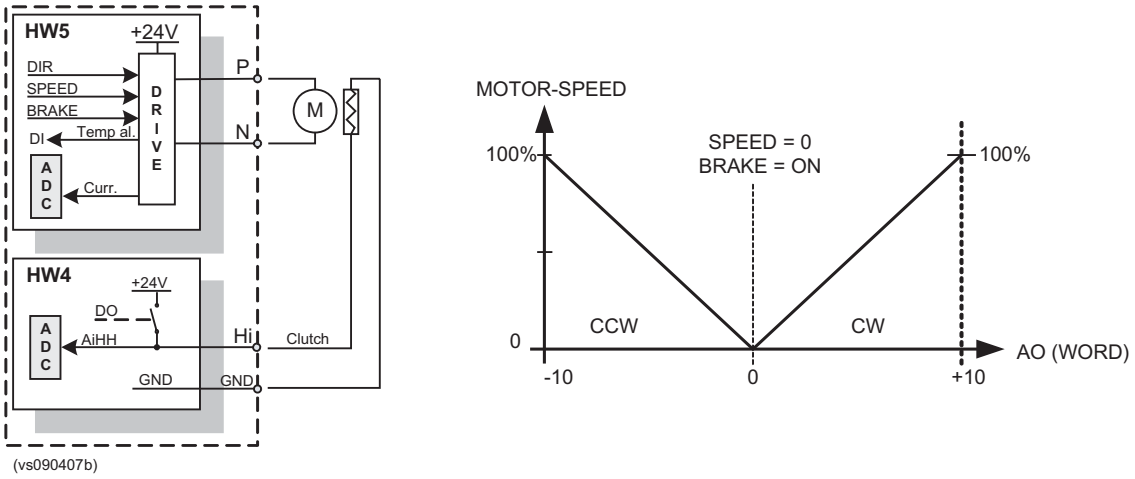
SPEED: controls the motor speed.

BRAKE: the P and N terminal are shorted to GND when on. Activated automatically when SPEED = 0.

This interface type is implemented for the following channels:

SW channels	HW channels
51 and 53	49 and 50

Figure 8 Loop typical information



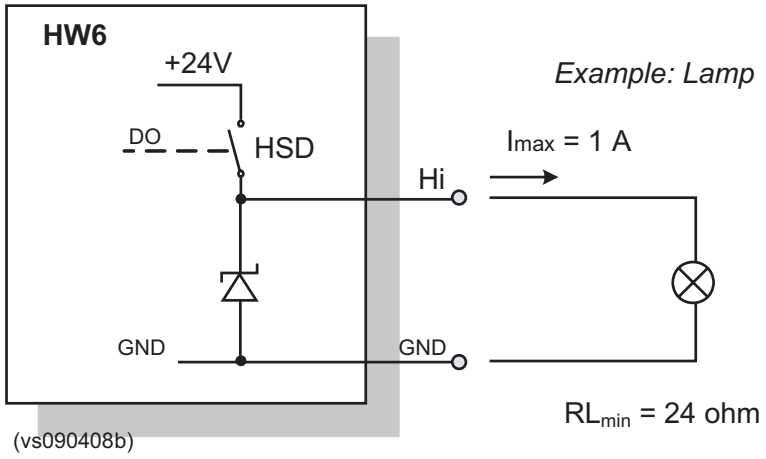
2.13 Backlight Driver with HSD (HW type 6)

The HSD circuit is used for switching on and of +24V. Max current = 1A. The output can be PWM, enabling dimming on external lamps. Typical use will be, driver for “24V panel backlight” with dimming facilities.

This interface type is implemented for the following channels:

SW channels	HW channels
35 and 36, 95 and 96	62, 84, CHX1, CHX2

Figure 9 Loop typical information



2.14 Dimmer input (HW type 7)

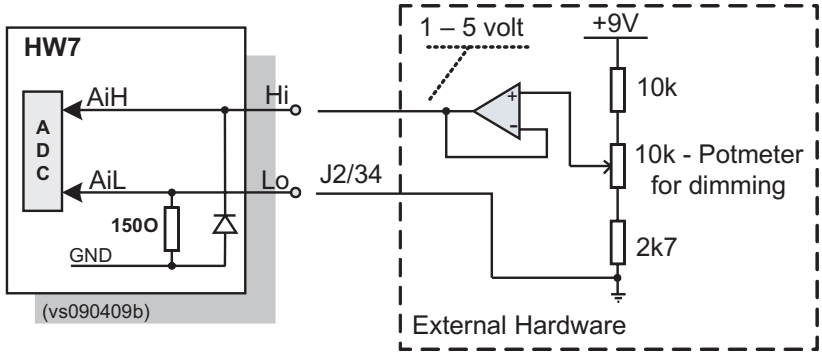
In general this interface is capable of reading analog voltage in the range 0 to 10V on Hi, or 0 to 20mA current on the Lo-terminal.

In the application shown below an analog voltage in the range 1 to 5 volt is read on the Hi-terminal, which will indicate the position on the external dimmer-potentiometer.

This interface type is implemented for the following channel:

SW channel	HW channel
86	64

Figure 10 Loop typical information



2.15 Electronic potentiometer output (HW type 8)

The circuit is typically used for replacing a standard, manual, low voltage and low current potentiometer.

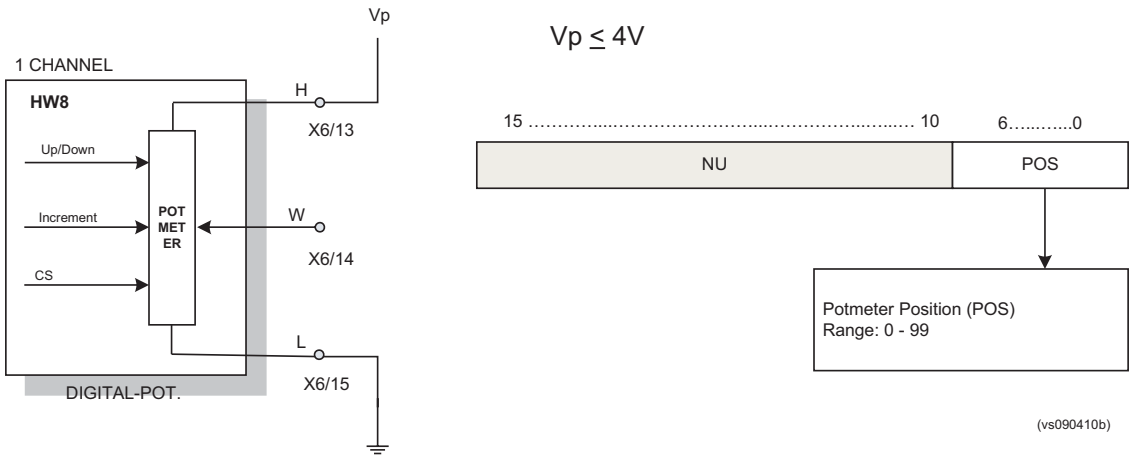
The value is 1 kohm linear in 99 increments. The voltage-difference on the potentiometer terminals H and L must not exceed Vp volt. (see *Technical specifications* on page 25 for details).

Typical application: The potentiometer output is controlled by dimmer input.

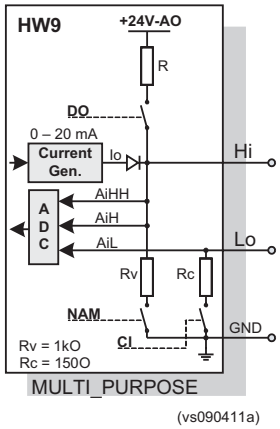
This interface type is implemented for the following channel:

SW channel	HW channel
90 (readback POS from potmeter)	POT

Figure 11 Loop typical information



2.16 Multipurpose current/voltage driver & analog/digital input (HW type 9)



This is a multipurpose interface. The following input/output options are available:

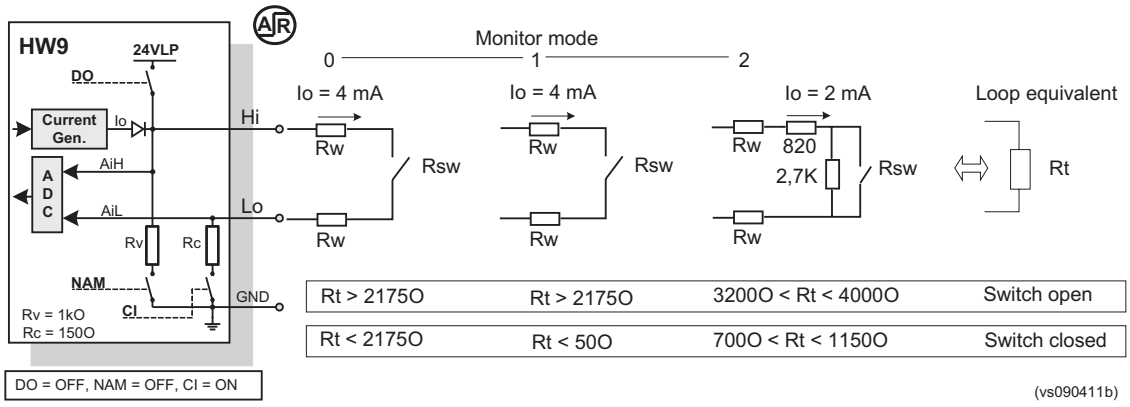
- DO is 24 Vdc, 100mA max
- AO can be 0 to 20 mA or 0 to 10V
- AI can be 0 to 20 mA or 0 to 10V

This Hardware type can also bee used as digital input as shown below.

This interface type is implemented for the following channels:

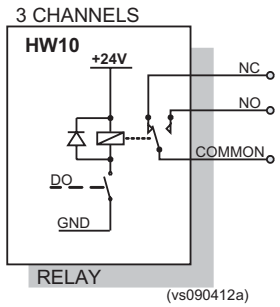
SW channels	HW channels
56 to 61	74 and 79

Figure 12 Loop typical information



Rw = wire resistance
Rsw = switch resistance
Rt = Rw + Rsw + Rw = 2*Rw + Rsw (for Monitor mode 0 and 1)

2.17 Relay (HW type 10)

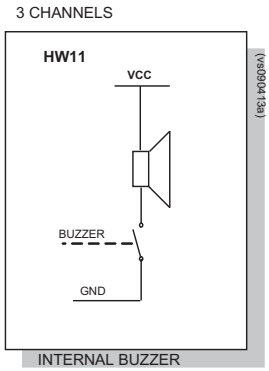


The DO signal will go on or off , operating the relay. Max rating: 6A / 250VAC.

This interface type is implemented for the following channels:

SW channels	HW channels
62 to 64	80 to 82

2.18 Internal buzzer (HW type 11)

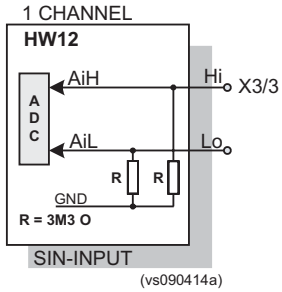


The frequency is controlled by the RCU. Frequency range: 10Hz to 658KHz.

This interface type is implemented for the following channels:

SW channels	HW channels
87 to 89	Internal

2.19 Sin input (HW type 12)

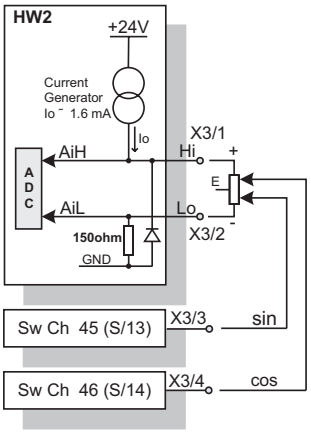


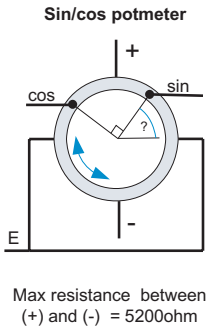
This is a high impedance voltage-input channel, dedicated to read the wiper-position from the sine/cosine potentiometer.

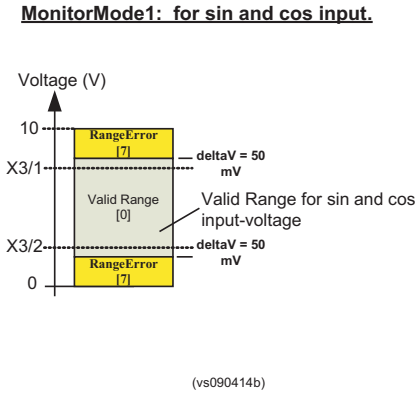
This interface type is implemented for the following channels:

SW channels	HW channels	Connector
45	44S	X3

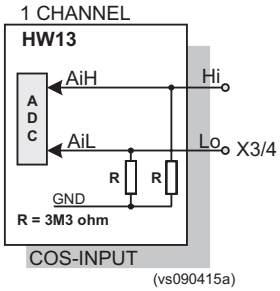
Figure 13 Loop typical information







2.20 Cos input (HW type 13)

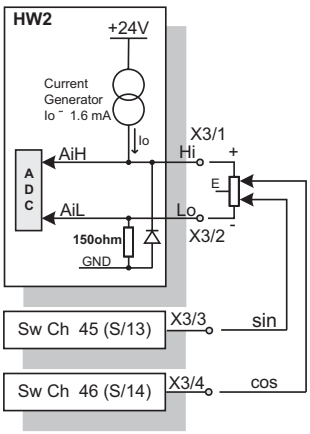


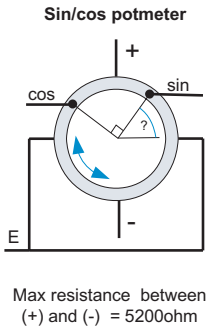
This is a high impedance voltage-input channel, dedicated to read the wiper-position from the sine/cosine potentiometer.

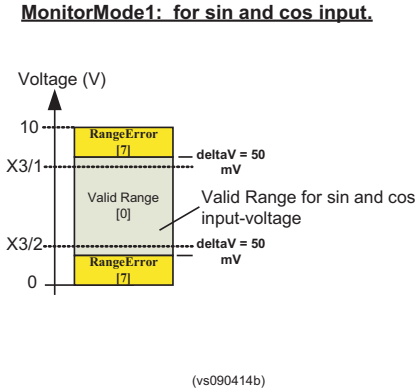
This interface type is implemented for the following channels:

SW channels	HW channels	Connector
46	44C	

Figure 14 Loop typical information







2.21 Self diagnostics

Extensive self-diagnostics are built into the RPC420 module to detect internal faults. As an example, all internally generated voltages are monitored, and the minimum and maximum values are stored for later diagnostic.

2.21.1 Module identification

The module has been programmed with a unique identification code (ID-code). This ID-code also identifies the type of module installed, so that the system can supervise that correct module is installed in the correct slot (address).

2.21.2 Status LED

A two-coloured LED (red /green) is visible on the front of the module.

Table 1 Status indicators (LED) on module front

Colour, status	**Function**
Green, fixed	The module has been scanned by the host within the FailSafe-timout time (IDF loc. 0x100B). (scanned = Read Input or Write Output message from the host (RCU)).
Green - dark, flashing	Normal operation. Dark flashing for each scan, i.e. input/output messages are received.
Red, fixed	After power-up. Soft Fail-safe is activated. Hard Fail-safe is activated. (Serious HW or SW error condition occurred).
Red - Green, flashing	Illegal address switch setting (00).

3 TECHNICAL SPECIFICATIONS

Power supply requirements	
Input voltage	18 to 32 V
Current consumption	Maximum 1.1 A (at 18 V)
Watch-dog	
I/O Soft Fail-safe time-out	Default value 6000 ms, programmable in the range 100 to 65535 ms (resolution 100 ms)
I/O Hard Fail-safe time-out	Is activated if the internal FW fail to trigger the watchdog within 60 ms
I/O channel specifications	
Analog to Digital Converter (ADC)	16 bit, ± 10 V range
Linearity	± 0.01% FS
Gain	± 0.02% FS
Drift	± 20 ppm/°C
Offset	± 30 mV
Digital to Analog Converter (DAC)	16 bit, 0 to 10V range
Linearity	0.02% FS
Gain	0.03% FS
Drift	± 30 ppm/°C
Offset	± 30 mV
Hardware 0 (SW Channels 1 to 34 and 65 to 85)	
LED driver - LED current:	10 mA typical, 15 mA maximum Pulse width modulation (PWM)
Digital input - Loop current:	10 mA typical, 15 mA maximum
Hardware 1 (SW Channels 39 to 42)	
Current output	0 - 20 mA
Voltage output	0 - 10 V, internal resistor 1 kohm
Hardware 2 (SW Channel 44)	
Sin/Cos potentiometer input:	
- Loop current	1.6 mA
- Potentiometer value	5702 ohm maximum
- Input resistor	150 ohm, 0.1%
Hardware 3 (SW Channels 47 to 50)	
Potentiometer input:	
- Loop current	1.6 mA maximum
- Potentiometer value	5702 ohm maximum
- Input resistor	150 ohm, 0.1%
Hardware 4, HSD (SW Channels 52 and 54)	
Voltage output	0 / 24 V (24VLP_fused)

Hardware 5, motor drive (SW Channels 51 and 53)	
Voltage output	0 / 24 V (pwm)
Hardware 6, HSD (SW Channels 35 and 36, 95 and 96)	
Voltage input	0 / 24 V (24VLP_fused)
Current output	1 A maximum (HSD has internal temp protection)
Hardware 7, Dimmer input (SW Channel 86)	
Voltage input on Hi	1 to 5 V
Current input resistor	150 ohm, 0.1%
Hardware 8, Digital Potmeter (SW Channel 90)	
Potmeter range	0 to 1 kohm, potmeter step 99 increments
Max potmeter voltage between H and L	4 V
Hardware 9 (SW Channels 56 and 61)	
Input current on Lo	0 to 20 (maximum 26,6 mA)
Input voltage on Hi	0 to 10 V
Potmeter range:	0 to 600 ohm
– Potmeter current	10,8 mA
Potmeter range:	0 to 1200 ohm
– Potmeter current	6,5 mA
Potmeter range:	0 to 12k ohm
– Potmeter current	0,7 mA
Potmeter range:	0 to 18k ohm
– Potmeter current	0,39 mA
Analog output current range:	0 to 20 mA
Analog output voltage range:	0 to 10 V (0 to 10mA via internal 1 kohm Rv resistor)
Hardware 10 (SW channel 62 to 64)	
Current / Voltage	6A / 250 V
Hardware 12 and 13 (SW channel)	
Voltage input on Hi (Sin)	0 to 10 V
Voltage input on Lo (Cos)	0 to 10 V
RBUS specifications	
Number of RBUS channels	2 x RBUS interface, available on the 9 pin male D-sub connector P1 and P2.
Bit rate	2 Mbps
RBUS signal coding	Manchester encoded (self-clocked)
Power supply voltage	18 to 32 Vdc

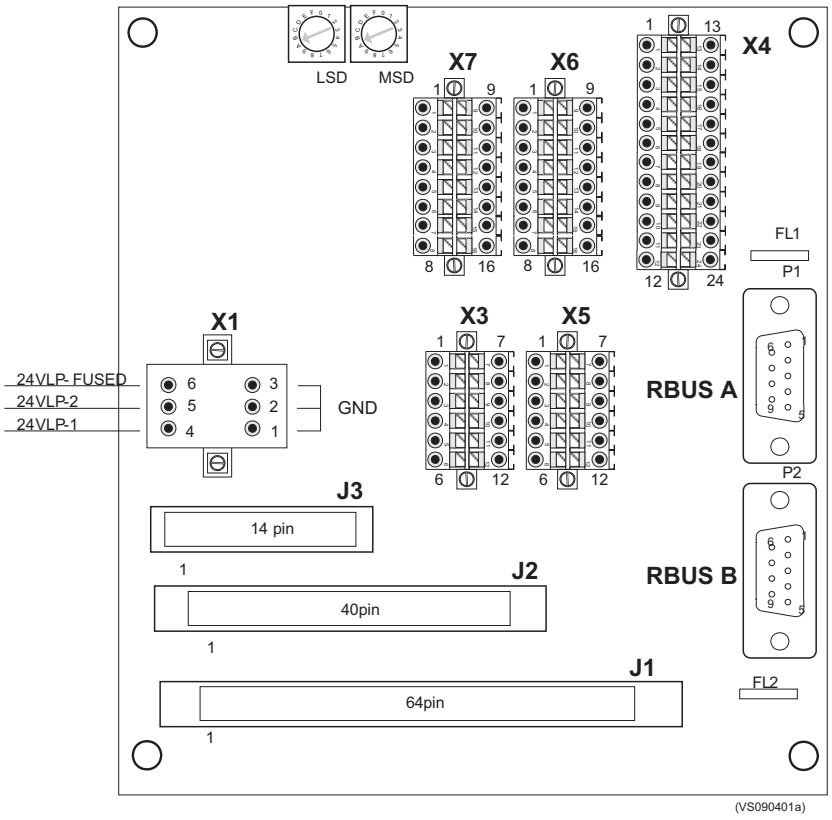
Current consumption	50 mA maximum at 24 Vdc per RBUS
Isolation voltage	500 V (optocoupler)
Cable capacitance requirement	≤ 50 pF/m
Mechanical specifications	
Module size	130 x 177 x 75 mm
Weight	0.6 kg
Mounting	To a bracket with 5 bolts through spacer sleves
Environmental requirements	
Operating temperature	-15 °C - +70 °C
Storage temperature	-25 °C - +70 °C
IP class	IP00
Compliant to standards	IEC 60945 and IACS E10
Life cycle specifications	
MTBF calculated according to MIL-HDBK-217F (T = 25°C, env. = GB)	547 945 hours
MTBF calculated according to MIL-HDBK-217F (T = 35°C, env. = NS)	147 945 hours

4 CONFIGURATION

Caution

Electrostatic charges can damage components on the card. Always wear a properly connected earthing strap when handling unpacked cards. Place unpacked cards only on a properly connected earthing mat or on a shielding bag. Keep cards in their shielding bags when not installed. Never store near electromagnetic or electrostatic devices.

Figure 15 Component layout



4.1 Module identification

If you have to refer to the RPC420 module in any way, you should refer to the module name (RPC420) and the Serial No. located in the upper left corner (see *Component layout* on page 28).

4.2 J1 connector (button and LED inputs for lever panel)

J1 is a 64 pin flat-cable connector primarily implemented for direct connection to a special button and LED matrix panel.

The connector pin-out is listed in the table below. For connector pin layout see *Component layout* on page 28.

The J1-connector interfaces to Hardware types 0, 1 and 6 (see function description).

Table 2 J1 terminal allocation

Pin no.	Function	Pin no.	Function	Device	Loop type	SW Ch	HW Ch	HW type
1	DI/DO Hi	2	GND	Lever Panel Button 1	DI-BUTTON	1	1	Type 0
3	DI/DO Hi	4	GND	Lever Panel Button 2	DI-BUTTON	2	2	Type 0
5	DI/DO Hi	6	GND	Lever Panel Button 3	DI-BUTTON	3	3	Type 0
7	DI/DO Hi	8	GND	Lever Panel Button 4	DI-BUTTON	4	4	Type 0
9	DI/DO Hi	10	GND	Lever Panel Button 5	DI-BUTTON	5	5	Type 0
11	DI/DO Hi	12	GND	Lever Panel Button 6	DI-BUTTON	6	6	Type 0
13	DI/DO Hi	14	GND	Lever Panel Button 7	DI-BUTTON	7	7	Type 0
15	DI/DO Hi	16	GND	Lever Panel Button 8	DI-BUTTON	8	8	Type 0
17	DI/DO Hi	18	GND	Lever Panel Button 9	DI-BUTTON	9	9	Type 0
19	DI/DO Hi	20	GND	Lever Panel Button 10	DI-BUTTON	10	10	Type 0
21	AO (0 to 5V)	22	not used	Lever Panel (Backlight dimm)	AO Normal	NA	CHAO 5H	Type 1
23	DO normal	24	GND	Alarm buzzer	DO-NORMAL	35	62	Type 6
25	DI/DO Hi	26	GND	Lever Panel Lamp D1	AOB-LED	13	13	Type 0
27	DI/DO Hi	28	GND	Lever Panel Lamp D2	AOB-LED	14	14	Type 0
29	DI/DO Hi	30	GND	Lever Panel Lamp D3	AOB-LED	15	15	Type 0
31	DI/DO Hi	32	GND	Lever Panel Lamp D4	AOB-LED	16	16	Type 0
33	DI/DO Hi	34	GND	Lever Panel Lamp D5	AOB-LED	17	17	Type 0

Table 2 J1 terminal allocation (cont'd.)

Pin no.	Function	Pin no.	Function	Device	Loop type	SW Ch	HW Ch	HW type
35	DI/DO Hi	36	GND	Lever Panel Lamp D6	AOB-LED	18	18	Type 0
37	DI/DO Hi	38	GND	Lever Panel Lamp D7	AOB-LED	19	19	Type 0
39	DI/DO Hi	40	GND	Lever Panel Lamp D8	AOB-LED	20	20	Type 0
41	DI/DO Hi	42	GND	Lever Panel Lamp D9	AOB-LED	21	21	Type 0
43	DI/DO Hi	44	GND	Lever Panel Lamp D10	AOB-LED	22	22	Type 0
45	DI/DO Hi	46	GND	Lever Panel Lamp D11	AOB-LED	23	23	Type 0
47	DI/DO Hi	48	GND	Lever Panel Lamp D12	AOB-LED	24	24	Type 0
49	DI/DO Hi	50	GND	Lever Panel Lamp D13	AOB-LED	25	25	Type 0
51	DI/DO Hi	52	GND	Lever Panel Lamp D14	AOB-LED	26	26	Type 0
53	DI/DO Hi	54	GND	Lever Panel Lamp D15	AOB-LED	27	27	Type 0
55	DI/DO Hi	56	GND	Lever Panel Lamp D16	AOB-LED	28	28	Type 0
57	DI/DO Hi	58	GND	Lever Panel Lamp D17	AOB-LED	29	29	Type 0
59	DI/DO Hi	60	GND	Lever Panel Lamp D18	AOB-LED	30	30	Type 0
61	EXT_LEDP	62	EXT_LEDN	Operation Lamp				
63	not used	64	GND					

4.3 J2 connector (utility panel)

J2 is a 40 pin flat-cable connector primarily implemented for direct connection to a special button and LED matrix panel called "Utility Panel".

The connector pin-out is listed in the table below. For connector pin layout see *Component layout* on page 28.

The J2-connector interfaces to Hardware type 0 (see function description).

Table 3 J2 terminal allocation

Pin no.	Function	Pin no.	Function	Device	Loop type	SW Ch	HW Ch	HW type
1	DI/DO Hi	2	GND	Utility Panel Button S1	DI-BUTTON	65	31	Type 0
3	DI/DO Hi	4	GND	Utility Panel Button S2	DI-BUTTON	66	32	Type 0
5	DI/DO Hi	6	GND	Utility Panel Button S3	DI-BUTTON	67	33	Type 0
7	DI/DO Hi	8	GND	Utility Panel Button S4	DI-BUTTON	68	34	Type 0
9	DI/DO Hi	10	GND	Utility Panel Button S5	DI-BUTTON	69	35	Type 0
11	DI/DO Hi	12	GND	Utility Panel Button S6	DI-BUTTON	70	36	Type 0
13	DI/DO Hi			Utility Panel Lamp D1	AOB-LED	74	37	Type 0
14	DI/DO Hi			Utility Panel Lamp D12	AOB-LED	85	66	Type 0
15	DI/DO Hi	16	GND	Utility Panel Lamp D2	AOB-LED	75	38	Type 0
17	DI/DO Hi			Utility Panel Lamp D3	AOB-LED	76	39	Type 0
18	DI/DO Hi			Utility Panel Lamp D11	AOB-LED	84	65	Type 0
19	DI/DO Hi	20	GND	Utility Panel Lamp D4	AOB-LED	77	40	Type 0
21	DI/DO Hi	22	GND	Utility Panel Lamp D5	AOB-LED	78	41	Type 0
23	DI/DO Hi	24	GND	Utility Panel Lamp D6	AOB-LED	79	42	Type 0
25	DI/DO Hi	26	GND	Utility Panel Lamp D7	AOB-LED	80	11	Type 0
27	DI/DO Hi	28	GND	Utility Panel Lamp D8	AOB-LED	81	12	Type 0
29	DI/DO Hi	30	GND	Utility Panel Lamp D9	AOB-LED	82	55	Type 0
31	DI/DO Hi	32	GND	Utility Panel Lamp D10	AOB-LED	83	56	Type 0
33	DI/DO Hi	34	GND	Dimmer	AI (controls LED intensity. Handled by FW).	86	64	Type 0
35	DI/DO Hi	36	GND	Utility Panel Button S8 (Lamp test input)	DI-BUTTON	72	CHX3	Type 0

Table 3 J2 terminal allocation (cont'd.)

Pin no.	Function	Pin no.	Function	Device	Loop type	SW Ch	HW Ch	HW type
37	DI/DO Hi	38	GND	Utility Panel Button S7 (Alarm buzzer silence)	DI-BUTTON	71	61	Type 0
39	DI/DO High	40	GND	Utility Panel Button S9	DI-BUTTON	73	67	Type 0

4.4 J3 connector (lever panel)

J3 is a 14 pin flat-cable connector primarily implemented for direct connection to a special button and LED matrix panel called "Lever Panel".

The connector pin-out is listed in the table below. For connector pin layout see *Component layout* on page 28.

The J3-connector interfaces to Hardware type is 0 (see function description).

Table 4 J3 terminal allocation

Pin no.	Function	Pin no.	Function	Device	Loop type	SW Ch	HW Ch	HW type
1	DI/DO Hi	2	GND	Lever Panel Button 11	DI-BUTTON	11	72	Type 0
3	DI/DO Hi	4	GND	Lever Panel Button 12	DI-BUTTON	12	73	Type 0
5	DI/DO Hi	6	GND	Lever Panel Lamp D19	AOB-LED	31	68	Type 0
7	DI/DO Hi	8	GND	Lever Panel lamp D20	AOB-LED	32	69	Type 0
9	DI/DO Hi	10	GND	Lever Panel lamp D21	AOB-LED	33	70	Type 0
11	DI/DO Hi	12	GND	Lever Panel lamp D22	AOB-LED	34	71	Type 0
13	not used	14	not used	not used				

4.5 X1 connector (power supply in and out)

X1 is a 6 pin terminal block for connection of input power and supply voltage to e.g. a lever panel.

The terminal-block pin-out is listed in the table below. For connector pin layout see *Component layout* on page 28.

Table 5 X1 terminal allocation

Pin no.	Name	Function	Pin no.	Name	Function
1	GND	Power supply_1, 0 Vdc terminal	4	24VLP-1	Power supply_1, 24 Vdc terminal
2	GND	Power supply_2, 0 Vdc terminal	5	24VLP-2	Power supply_2, 24 Vdc terminal
3	GND	0 Vdc terminal for power to external load (e.g. lever panel)	6	24VLP-FUSED	Fused 24 Vdc terminal for power to external equipment (e.g. lever panel)

4.6 X3 connector (lever potentiometers)

X3 is a 12 pin terminal block dedicated for connection to lever potentiometers.

The terminal-block pin-out is listed in the table below. For connector pin layout see *Component layout* on page 28.

Hardware types are 2, 3, 12 and 13 (see function description).

Table 6 X3 terminal allocation

Pin no.	Function	Pin no.	Function	Device	Loop type	SW Ch	HW Ch	HW type
1	AI Hi	2	AI Lo	Lever potentiometer Sin/Cos source	AI	44	43	Type 2
3	AI Hi			Lever potentiometer Sin Wiper	AI	45	44S	Type 12
4	AI Lo			Lever potentiometer Cos Wiper	AI	46	44C	Type 13
5	AI Hi	6	AI Lo	Lever potentiometer	AI	47	45	Type 3
7	AI Hi	8	AI Lo	Lever potentiometer	AI	48	46	Type 3
9	AI Hi	10	AI Lo	Lever potentiometer	AI	49	47	Type 3
11	AI Hi	12	AI Lo	Lever potentiometer	AI	50	48	Type 3

4.7 X4 connector (lever motors and clutches)

X4 is a 24 pin terminal block dedicated for connection to lever motors and clutches.

The terminal-block pin-out is listed in the table below. For connector pin layout see *Component layout* on page 28.

Hardware types are 4, 5, 6 and 9 (see function description).

Table 7 X4 terminal allocation

Pin no.	Function	Pin no.	Function	Device	Loop type	SW Ch	HW Ch	HW type
1	AO Hi	2	Lo	Lever motor #1 (speed)	AO +/- 24V PWM	51	49	Type 5
3	DO Hi	4	GND	Lever motor #1 (clutch)	DO HSD	52	51	Type 4
5	AO Hi	6	Lo	Lever motor #2 (speed)	AO +/- 24V PWM	53	50	Type 5
7	DO Hi	8	GND	Lever motor #2 (clutch)	DO HSD	54	52	Type 4
9	not used							
10	DO Hi	11	GND	Command transfer buzzer ON	DO-NORMAL	36	84	Type 6
12	not used							
13	Hi	14	GND	CAS Silence Input	Multi Purpose	56	74	Type 9
		15	Lo					
16	Hi	17	GND	Spare	Multi Purpose	57	75	Type 9
		18	Lo					
19	Hi	20	GND	Spare	Multi Purpose	58	76	Type 9
		21	Lo					
22	Hi	23	GND	Spare	Multi Purpose	59	77	Type 9
		24	Low					

4.8 X5 connector (instruments)

X5 is a 12 pin terminal block for mainly connection to current-loop driven meters.

The terminal-block pin-out is listed in the table below. For connector pin layout see *Component layout* on page 28.

Hardware types are 1 and 3 (see function description).

Table 8 X5 terminal allocation

Pin no.	Function	Pin no.	Function	Device	Loop type	SW Ch	HW Ch	HW type
1	Hi	2	GND	Instrument #1	AO (0-20mA)	39	57	Type 1
3	Hi	4	GND	Instrument #2	AO (0-20mA)	40	58	Type 1
5	Hi	6	GND	Instrument #3	AO (0-20mA)	41	59	Type 1
7	Hi	8	GND	Instrument #4	AO (0-20mA)	42	60	Type 1
9	Hi (J1/21)	10	GND	Lever Panel	Dimming	–	CHAO 5H	Type 1
11	Hi	12	Lo	Multi position switch	AI (Potmeter)	43	63	Type 3

4.9 X6 connector (panel controls)

X6 is a 16 pin terminal block for connection to a control panel.

The terminal-block pin-out is listed in the table below. For connector pin layout see *Component layout* on page 28.

Hardware types are 0, 6, 7 and 8 (see function description).

Table 9 X6 terminal allocation

Pin no.	Function	Pin no.	Function	Device	Loop type	SW Ch	HW Ch	HW type
1	Hi	2	GND	Utility Panel Button S7 (Alarm buzzer silence)	DI-BUTTON	71	61	Type 0
3	Hi	4	GND	Alarm Buzzer ON	DO-NORMAL	35	62	Type 6
5	Hi	6	GND	Dimmer	AI (Controls LED intensity. Handled by FW).	86	64	Type 7
7	Hi	8	GND	Utility Panel Button S8 (Lamp Test Input)	DI-BUTTON	72	CHX3	Type 0
9	Hi	10	GND	Backlight-LED (PWM)	Dimming	95	CHX1	Type 6
11	Hi	12	GND	Backlight-24V (PWM)	Dimming	96	CHX2	Type 6

Table 9 X6 terminal allocation (cont'd.)

Pin no.	Function	Pin no.	Function	Device	Loop type	SW Ch	HW Ch	HW type
13	H	14	W	Digital Potmeter	LT_AOB_ DIGITAL_ POTMETER_ HW8	90	POT	Type 8
		15	L					
16	not used							

4.10 X7 connector (multipurpose and relay)

X6 is a 16 pin terminal block for multipurpose use and relay.

The terminal-block pin-out is listed in the table below. For connector pin layout see *Component layout* on page 28.

Hardware types are 9 and 10 (see function description).

Table 10 X7 terminal allocation

Pin no.	Function	Pin no.	Function	Device	Loop type	SW Ch	HW Ch	HW type
1	Hi	2	GND	Spare		60	78	Type 9
		3	Lo					
4	Hi	5	GND	Spare		61	79	Type 9
		6	Lo					
7	COM	8	NO	Lamp Test Output	DO Relay	62	80	Type 10
		9	NC					
10	COM	11	NO	CAS Alarm Output	DO Relay	63	81	Type 10
		12	NC					
13	COM	14	NO	Spare	DO Relay	64	82	Type 10
		15	NC					
16	not used							

4.11 RBUS A (P1), RBUS B (P2) pin allocation

RBUS A and RBUS B are 9-pin female DSUB connectors. They connect the module to the multi-drop serial bus cables.

The connector pin-out is listed in the table below. For connector pin layout see *Component layout* on page 28.

Table 11 RBUS A and RBUS B pin allocation

Pin no.	RBUS A	RBUS B	Function
1	ADATA_H	BDATA_H	RS485 serial line H
2	ADATA_L	BDATA_L	RS485 serial line L
3	A24VGND	B24VGND	24V ground for RS485 transmitter /receiver
4	not used	not used	
5	A24V	B24V	+24V for isolated RS485 transmitter /receiver
6	A5V	B5V	Isolated +5V for the RBUS line (internally generated +5V for RBUS receive/transmit circuits)
7	A24VGND	B24VGND	24V ground for RS485 transmitter /receiver
8	not used	not used	
9	not used	not used	

4.12 DIP switches for selecting RBUS line-impedance

There are two DIP switches on the RPC420. One for RBUS A and one for RBUS B.

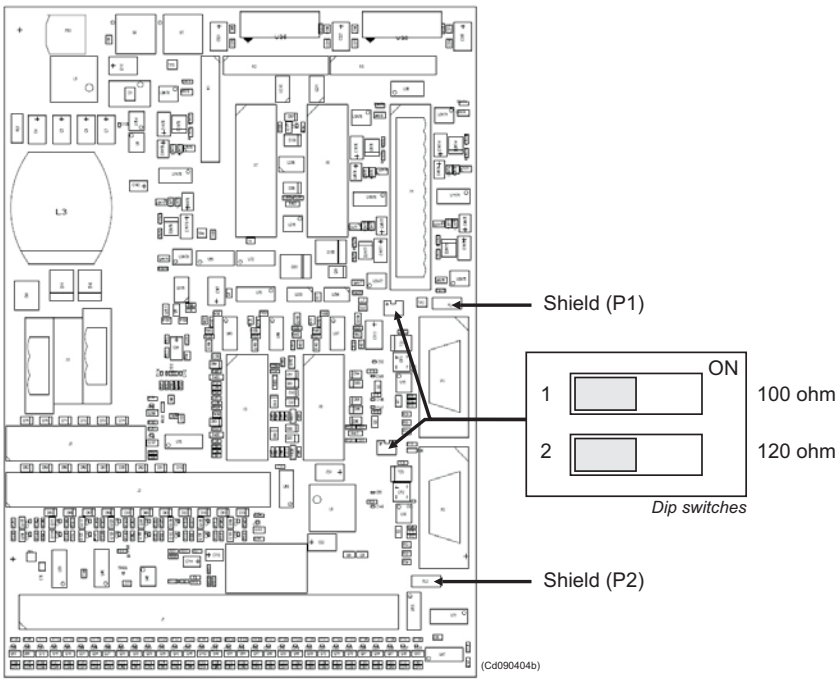
At the end of a RBUS-line, the dip switches enable the user to select the line-impedance to 100 (revolved cabled) or 120 (CAT7 cable) ohm, to avoid reflections on the RBUS-line.

Note

Normally the line-impedance is done outside the module by the BusTerm-module.

RBUS A	RBUS B
SW1–A: 100 ohm	SW1–B: 100 ohm
SW2_A: 120 ohm	SW2–B: 120 ohm

Figure 16 DIP Switches



4.13 SHIELD P1 and SHIELD P2

Two fast-on terminals SHIELD P1 and SHIELD P2 are respectively connected to the two RBUS connectors P1 and P2 (9-pin D-sub) inner cable shields. The SHIELD P1 and SHIELD P2 are normally wired to IE or to system ground (PE). RBUS outer shield is normally connected to PE.

For location of the shields, see figure above (DIP Switches).

5 INSTALLATION

Caution

Electrostatic charges can damage components on the card. Notice the following precautions: Always wear a properly connected earthing strap when handling unpacked cards. Place unpacked cards only on a properly connected earthing mat or on a shielding bag. Keep cards in their shielding bags when not installed. Never store near electromagnetic or electrostatic devices.

1 Label the module.

2 Set correct address to the module by rotating the two decimal switches (addresses 1 to 99).

3 Fix the module to the appropriate bracket by fastening the four corner screws using a flat-bit screwdriver.

4 Connect wires to the FAST-ON receptacles SHIELD P1 and SHIELD P2 as appropriate.

5 Connect power wires to the terminal block X1.

6 Connect field wires to the terminals on X3, X4, X5, X6 and X7.

7 Connect the three flat-cables to the connectors J1, J2 and J3.

8 Connect the RBUS cables to the connectors P1 (RBUS A) and P2 (RBUS B), and fasten the connectors by using the screws.

9 Switch on the power to the module.

10 Check the module's panel function by pressing the lamp test button of the corresponding button panel, if a such panel is connected.

11 Verify the RUN lamp turns to green when connected in a running host system.

12 Verify proper module operation by using the set of functions of the connected panels in a running system.

6 REPLACEMENT

Caution

Electrostatic charges can damage components on the card. Notice the following precautions: Always wear a properly connected earthing strap when handling unpacked cards. Place unpacked cards only on a properly connected earthing mat or on a shielding bag. Keep cards in their shielding bags when not installed. Never store near electromagnetic or electrostatic devices.

1 Switch off the power to the module.

2 Remove the RBUS cables by loosen the fasting bolts for connectors P1 and P2, and pull the connectors out.

3 Disconnect the flatcables in J1, J2 and J3 by using the connector ejectors, one at each end of the connector.

4 Disconnect the field wires from the terminal blocks X3, X4, X5, X6 and X7 by loosen the end bolts, split and remove the block header.

5 Disconnect the power wires from the terminal block X1 by loosen the four end bolts, split and remove the block header.

6 Remove wires from the FAST-ONs SHIELD P1 and SHIELD P2 by pulling them out (grip the connector and not the wire).

7 Remove the four corner screws that fixes the module to the bracket by using a flat-bit screwdriver.

8 Remove the module and mark it with the fault symptoms.

9 Label the new module.

10 Set correct address to the module by rotating the two decimal switches to the same values as of the old module.

11 Fix the module to the bracket by fastening the four screws, one at each corner, using a flat-bit screwdriver.

12 Connect the wires to the SHIELD P1 and SHIELD P2 as appropriate.

13 Reconnect the connector header to the terminal block X1 and fasten the four fixing bolts.

14 Reconnect the connector headers to the terminal blocks X3, X4, X5, X6 and X7 and fasten the corresponding fixing bolts.

15 Reconnect the flat-cables to the connectors J1, J2 and J3 by pushing them into the sockets.

16 Reconnect the RBUS cables to the connectors P1 (RBUS A) and P2 (RBUS B), and fasten the connectors by using the corresponding fastening bolts.

17 Switch on the power circuit to the module.

18 Check the module's panel function by pressing the lamp test button of the corresponding button panel, if a such panel is connected.

19 Verify that the Status-LED turns to green when connected in a running host system.

20 Verify proper module operation by using the set of functions of the connected panels in a running system.

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