

DCU 305 R2

Communication Manual

Auto-Maskin AS





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Document information

Document revisions

Update
Created
Supports AK-6
LOCAL mode added
Analog scale refinement
Described 2-wire interface
Multiple slave panels
ICPCON wiring description
Modbus addressing
Modbus is Even parity, not None parity as described in the February 2004 edition.
Corrected wrong addressing of some analogue channels 12-17.
Details on Modbus support added.
Scaling Factors corrected.
Simplified list

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Related articles

• Rudolf R2 Configuration Software. Article 75270.



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Communication

In General

The DCU 305 Control Unit has built-in support for communication towards a control panel. The control panel can display an overview of one or several DCU 305 panels.

This control panel can be one of several types on the market. We have standardised on a suite of panels, but others can be used.

The possibilities for communication are limited only by imagination. Feel free to contact us for special needs or requirements.

The protocols

The Control Unit has two protocols implemented. These are Modbus RTU^{I} and Comli.

The Control Unit detects these two protocols automatically, and no configuration is necessary.

In general, the communication interface is RS-232, 9600 baud, 8 databits and 1 stopbit.

Note!

For Modbus, use **Even** Parity. For Comli, use **Odd** Parity.

¹ From firmware 4.24



ID-number

The correct ID-number must be set in the Control Unit for this to work correctly. Please refer to the ID-number section.

🖺 Select ID Number	×
If communicating over a modem or network, please set the required id-number in the range	ОК
1-239.	Cancel
ID Number 17	
Other communication parameters are:	
9600,o,8,1	

Setting the ID-number using Rudolf R2

Note!

When communicating towards several DCU 305 units, the ID-number must be unique in the network.

Signal Converters – when and why do I need them?

The RS-422/RS-485 interface module must be used in two cases:

- When the total distance from the Slave panel to the DCU 305 R2 is longer than 8 meters.
- When communicating to more than one DCU 305 R2. This is often referred to as a multidrop network.

This is summarised in the table below.

Configuration	<8 m	8-1200m
Communicating from one Slave panel to one DCU 305 unit.		\checkmark
Communicating from one Slave panel to several DCU 305 units.	\checkmark	~

✓ = Signal Converter necessary.



Communicating to one Control Unit only

Short distances

If the distance between the supervision panel and the DCU 305 control unit is less than 8 meters, RS-232 communication can be used directly towards the RS-232 connector on the DCU 305.

Fifteen meters is the IEEE recommended maximum distance when using RS-232. Practical tests prove that even 100 meters works fine. However, we do not recommend going above 8 meters in marine or industrial installations.

When using an RS-232 connection between unites, take care to locate the RS-232 cable (and other communication cables) apart (5cm) from other kinds of cables. And make sure both units get their power from the same source.



Longer distances

For longer distances (<1200m), we employ an RS-232/RS-422 converter box. These are available from several vendors.

We recommend using the Phoenix PSM-ME or ICPCON units.





Communicating towards several Control Units

When communicating from a supervision panel towards two or more DCU 305 panels, RS-422 must always be used.

You can choose between 4-wire RS-422 and 2-wire RS-485 connections.

A maximum of 31 Control Unit's can be connected in a network towards the same supervision panel, in what is known as a multidrop² network.

Each Control Unit must have its unique ID-number. The number can be any number in the range 1-237, but it must be unique in the network.

Note! If using the Auto-Maskin SP 305 slave panel, the E-615 or E-910 type panels, the ID-number must be less than 32, as this is the highest supported ID-number on these panels.

The number is configured using the Rudolf configuration software.



² Multidrop network: One Slave panel communicating towards several (more than one) units. There can be a maximum of 32 units in one network.



RS-232/RS-485 signal converters

In a multidrop network, RS-422/RS-485 signals must be used. The signal converters above convert the RS-232 signals in the DCU 305 to RS-422.

The RS-422/RS-485 signals can be used for distances up to 1200 meters. For longer distances, RS-422 repeaters can be used.

We recommend using the Phoenix or ICPCON converters.

The Phoenix PSM-ME dip setting is outlined below. The ICPCON converter is configured automatically.

Phoenix PSM-ME DIP setting

Opt for 4-wire or 2-wire connections and set dip-switches accordingly:

A) 4-wire RS-422

- Set the following Dip's to <u>ON: 1, 3, 4 and 7</u>. The remaining Dip's 2, 5, 6 and 8 should be OFF.
- The DTE/DCE-switch must be set to DTE.

B) 2-wire RS-485

- Set the following Dip's to <u>ON: 1, 3 and 4</u>. The remaining Dip's 2, 5, 6, 7 and 8 should be OFF.
- The DTE/DCE-switch must be set to DCE.

Note! "Terminate RS485/RS422" should be set to ON if this is the last converter in the RS422-network. Set to OFF otherwise.

The above Phoenix converter dip setting will work in single systems (one slave panel towards one control unit) and in multidrop networks (one slave panel towards several control units).



Multiple Slave Panels

In some projects it may be necessary with several slave panels.



In the above example, two slave panels are used. To activate this function, use the configuration tool for the slave panels, E-Designer[®].

Master 1

In the Setup menu select **Peripherals**. Select **Transparent Mode** for the port connected to the second slave panel.

This means that any requests on that port will be transferred to the port connected to the control units. This can be done with both the RS-232 and the RS-422 port.

Master 2

No special preparation or modification necessary.

Communication format (baud rate, parity, stop- and databits) for the connected ports on the slave panels must be the same.

Note that the distance limits for the RS-232 and the RS-422 still apply, and that signal converters can be used to expand this.

Note! For Comli, this feature *requires* that the software-driver in the E-panels is 3.02.3 or newer.



Cabling

Various RS232/422 converters

A number of different RS232/RS422 converter modules exist. The following describes the connections for two popular types:

- Phoenix PSM-ME •
- ICPCON I-7520AR •

These will be referenced as Phoenix or Icpcon respectively.

Wiring DCU 305 – Phoenix Converter

The cable between the DCU 305 and the Phoenix converter can be max 8 meters long. This is an RS-232 cable with the following configuration:

DCU 305, 9P DSUB F Phoenix, 9P DSUB F Length: 60cm 2 2 3 3 5 5 Shield NC

Connect the shield at one end of the cable only.

Wiring DCU 305 – Icpcon Converter

The cable between the DCU 305 and the Icpcon converter can be max 8 meters long. This is an RS-232 cable with the following configuration:

Article: 08227	DCU 305, 9P DSUB F	Icpcon, 9P DSUB M
Lengin. oocin	2	2
	3	3
	5	5
	Shield	NC

Article: 08224



Wiring DCU 305 – E615 Remote panel

In a 1-to-1 installation, the RS232 port on the E615 can be used directly.

The cable between the DCU 305 and the E615 remote panel shall be max 15 meters long.

Article: 08227 Length: 60cm	DCU 305, 9P DSUB F	E615, 9P DSUB F
	2	2
	3	3
	5	5
	Shield	NC

Wiring Phoenix – Phoenix

The cable between the converters must be a double twisted pair. Total length of this cable must be less than 1200 meters.

Select

- A) RS-422 4-wire, or
- B) RS-485 2-wire connections

... and connect the cables accordingly.

4-wire RS-422 connections A)

Phoenix Terminals	Phoenix Terminals
D(A)	D(A)
D(B)	D(B)
T(A)	T(A)
T(B)	T(B)

2-wire RS-485 connections B)

Phoenix Terminals	Phoenix Terminals
D(A)	D(A)
D(B)	D(B)



Wiring Icpcon – Icpcon

The cable between the converters must be a double twisted pair. Total length of this cable must be less than 1200 meters.

Select

- A) RS-422 4-wire, <u>or</u>
- B) RS-485 2-wire connections
- ... and connect the cables accordingly.

Icpcon Terminals	Icpcon Terminals
RX+	RX+
RX-	RX-
TX+	TX+
TX-	TX-

A) 4-wire RS-422 connections



B) 2-wire RS-485 connections

Icpcon Terminals	Icpcon Terminals
Data+	Data+
Data-	Data-

In essence, connect the cable in parallel between all converter modules.

Wiring Phoenix – E-615/E910 Slave panel

A) 4-wire RS-422 connection

The cable between the converter and the Slave panel must be a double twisted pair (4 wires).

Phoenix Terminals	Slave panel, DSUB 25 M
D(A)	15
D(B)	2
T(A)	16
T(B)	3

B) 2-wire RS-485 connection

The cable between the converter and the Slave panel must be a single twisted pair (2 wires).

Phoenix Terminals	Slave panel Terminals
D(A)	T(x)/R(x)+
D(B)	T(x)/R(x)-

C) 3-wire RS-232 connection

The cable between the converter and the Slave panel must be a shielded 3-wire cable.

Phoenix RS-232 DSUB	Slave panel RS-232 DSUB	
2	2	
3	3	
5	5	
Shield	NC	



Wiring Icpcon – E-615/E910 Slave panel

A) 4-wire RS-422 connections

The cable between the converter and the Slave panel must be a double twisted pair (4 wires).

Icpcon Terminals	Slave panel, DSUB 25 M	
RX-	15	
RX+	2	
TX-	16	
TX+	3	

B) 2-wire RS-485 connections

The cable between the converter and the Slave panel must be a single twisted pair (2 wires).

Icpcon Terminals	Slave panel Terminals	
Data+	T(x)/R(x)+	
Data-	T(x)/R(x)-	

Wiring Slave panel – PLC

When communicating directly between an E615/E910 slave panel and a Mitsubishi FX2N PLC, the following wiring can be used.

A) 4-wire RS-422 connections

The cable between the Slave panel and the PLC must be a double twisted pair (4 wires).

E-type Slave panel,	FX2N PLC,	
RS-422 port	BD-485 card ³	
15	RDB	
2	RDA	
16	SDB	
3	SDA	

³ Note! The PLC is equipped with the BD-485 card as standard from Auto-Maskin.



B) 2-wire RS-485 connections

The cable between the Slave panel and the PLC must be a single twisted pair (2 wires).

E-type Slave panel,	FX2N PLC, BD-485 card	
RS-485 port		
TX/RX –	SDB/RDB	
TX/RX +	SDA/RDA	

Wiring Slave panel – Slave panel

A) RS-232 connection

The cable between the slave panels can be max 8 meters.

Slave panel,	Slave panel,	
RS-232 port	RS-232 port	
2	3	
3	2	
5	5	

B) RS-422 connection

The cable between the slave panels can be max 1200 meters.

Slave panel,	Slave panel,	
RS-422 port	RS-422 port	
2	3	
3	2	
15	16	
16	15	
7	7	
8	8	



Available signals for communication

The following lists the available signals in the Control Unit.

Slave panels and Supervision Systems (Wheelhouse panel in general) can access all status bits in any random order.

Status

A one (1) means an activated signal unless otherwise stated.

Registers

The analogue address field (Registers, page 24) are 16-bit values in the range 0 - 65535, unless specifically stated otherwise.

The analogue channels have different scaling factors – dependent upon the channel range.

The channel range is the maximum values minus the minimum value.

For 4-20mA inputs this results in the following scaling factors, depending on the maximum value and assuming the minimum value is zero.

Scaling

	4-20mA	Scaling Factor
	Sensor Range	
	From To	
0	2.2	0.0001
0	2.3 - 50.9	0.001
0	51 - 509.6	0.01



Scaling Factor	4-20mA	
	Sensor Range	
	From To	
0.1) 509.7 –	0

Example: Before displaying a value with the range 0-100 you should multiply it with 0.01 .

For the 0-10 volt input option the "To" digits above are, for instance 664.9 instead of 509.6, etc.

RPM always has Scaling Factor 1.

Below are the scaling factors for J1939 instruments (for the Rudolf default J1939 configuration).

J1939 Instruments		Scaling factor
Instrument	Units	
Accelerator pedal position 1	%	0.1
Air filter differential pressure	kPa	0.01
Air inlet pressure	Bar	0.001
Barometric pressure	Bar	0.001
Boost pressure	Bar	0.001
Coolant level	%	0.1
Coolant pressure	Bar	0.001
Coolant temperature	С	0.1
Crankcase pressure	Bar	0.01
Engine auxiliary coolant pressure	kPa	1
Engine intercooler temperature	С	0.1
Engine load	%	0.1
Engine oil level	%	0.1
Engine oil pressure	Bar	0.01
Engine oil temp.	С	0.1
Engine RPM	RPM	1
Exhaust temp.	С	1
Fuel delivery pressure	Bar	0.01
Fuel filter differential pressure	kPa	0.1
Fuel rate	l/h	1
Fuel temperature	С	0.1
Intake manifold temp.	С	0.1
Left manifold exhaust temp.	С	1



J193	Scaling factor	
Instrument	Units	
Oil filter differential pressure	Bar	0.001
Pre filter fuel pressure	Bar	0.001
Pre filter oil pressure	Bar	0.01
Right manifold exhaust temp	С	1
Transmission oil pressure	Bar	0.01
Transmission oil temp.	С	1
Turbocharger 1 Comp. Inlet	kPa	1
Turbocharger 2 Comp. Inlet	kPa	1

Modbus

The MODBUS function codes supported are 1, 2, 3, 4, 5, 6, 16, and 43.

The DCU provides RS-232, 9600 baud, 8 databits and 1 stopbit and even parity for Modbus.

Rx and Tx are located on the same pins as on a PC COM port.

Note! The MODBUS addresses below are given with an offset of one.

Thus, if the Modbus master protocol supports an offset of '0' or '1', make sure this is set to '1'.



Commands

Set the bit-address high (logic "1") to activate a command. The Control Unit will set the address low after processing the command.

Comli Address	Modbus Address	Signal	Comment
0	1	Acknowledge	Works as local Acknowledge button. A Set/Reset command is necessary in the slave panel.
1	2	Start	Works as the "Blackout Start" input, ie starts using all configured start attempts.
2	3	Stop	Works as the local Stop-button
3	4	305 A: Manual	Set to Manual mode
3	4	305 P: N/A	N/A
4	5	305 A: Standby	Set to Standby mode
4	5	305 P: N/A	N/A
5	6	Delayed Stop	Works as the "Delayed Stop" input. An Acknowledge resets it.
6		-	Reserved
7		-	Reserved



Switch (on/off) status

Address Comli	Address Modbus	Signal	Latched	Comment
10	10009	Start/Running LED		Indicates a running engine
11	10010	Standby LED		Control unit in Standby mode
12	10011	Stop LED		Indicates control unit in stopping mode
13	10012	DCU 305 R2: Alarm LED		One or more alarms, acknowledged or not.
		DCU 305 R1: Shutdown/Alarm LED		One or more shutdowns/Alarms, acknowledged or not.
14	10013	R2: Warning LED		Warning(s) present, acknowledged.
		R1: N/A		
16	10015	R2: Shutdown LED		All shutdowns
		R1: Shutdown/		Shutdown/Alarm not acknowledged.
		Alarm LED		
17	10016	More alarms LED		>1 alarms LED
		LED statuses above are Not affected by Lamp Test		
23	10020	Alarm LED flashing		Not acknowledged alarm(s)
24	10021	Warning LED flash		Not acknowledged warning(s)
30	10025	Local mode selected		1 = Local mode selected
100	10065	Config.2 on Terminal 62		RK-66 R2 input
101	10066	Config.1 on Terminal 61		RK-66 R2 input
106	10071	Cranking		In Cranking mode
107	10072	Keyswitch On		1=On, 0=Off
110	10073	Shutdown override		Input to Control Unit
130	10089	Remote reset		Input To Control Unit
131	10090	Delayed stop command		Input To Control Unit
132	10091	Blackout Start command		Input To Control Unit
133	10092	Remote stop		Input To Control Unit
214	10141	Backlight On/Off		1=On, 0=Off
215	10142	LCD Backlight brightness		1=Full, 0=Half
220	10145	Configurable Relay K7		K7, Configurable in Rudolf
221	10146	Ready relay, K8		K8, Control unit ready to start.
222	10147	Configurable Relay, K9		K9, Configurable in Rudolf
223	10148	Shutdown relay, K6		K6
224	10149	Alarm relay, K5		K5
225	10150	Shutdown relay, K4		K4
226	10151	Run relay, K3		К3
227	10152	Stop solenoid relay, K2		К2
230	10153	MK-14, 8		Optional relay card, relay 8
231	10154	MK-14, 7		Optional relay card, relay 7



Address Comli	Address Modbus	Signal	Latched	Comment
232	10155	MK-14, 6		Optional relay card, relay 6
233	10156	MK-14, 5		Optional relay card, relay 5
234	10157	MK-14, 4		Optional relay card, relay 4
235	10158	MK-14, 3		Optional relay card, relay 3
236	10159	MK-14, 2		Optional relay card, relay 2
237	10160	MK-14, 1		Optional relay card, relay 1
242	10163	MK-14, 14		Optional relay card, relay 14
243	10164	MK-14, 13		Optional relay card, relay 13
244	10165	MK-14, 12		Optional relay card, relay 12
245	10166	MK-14, 11		Optional relay card, relay 11
246	10167	MK-14, 10		Optional relay card, relay 10
247	10168	MK-14, 9		Optional relay card, relay 9
306	10199	Switch 1 Broken Wire ⁴		
307	10200	$W/A/S^5$, SW-1	Yes	
316	10207	Switch 2 Broken Wire		
317	10208	W/A/S, SW-2	Yes	
326	10215	Switch 3 Broken Wire		
327	10216	W/A/S, SW-3	Yes	
336	10223	Switch 4 Broken Wire		
337	10224	W/A/S, SW-4	Yes	
346	10231	Switch 5 Broken Wire		
347	10232	W/A/S, SW-5	Yes	
356	10239	Switch 6 Broken Wire		
357	10240	W/A/S, SW-6	Yes	
367	10248	W/A/S, SW-7	Yes	
377	10256	W/A/S, SW-8	Yes	
407	10264	W/A/S, SW-9	Yes	
417	10272	W/A/S, SW-10	Yes	
427	10280	W/A/S, SW-11	Yes	
437	10288	W/A/S, SW-12	Yes	
446	10295	AI-1, Broken Wire	Yes	
447	10296	W/A/S, AI-1	Yes	
456	10303	AI-2, Broken Wire		
457	10304	W/A/S, AI-2	Yes	
466	10311	AI-3, Broken Wire		
467	10312	W/A/S, AI-3	Yes	
476	10319	AI-4, Broken Wire		
477	10320	W/A/S, AI-4	Yes	
506	10327	AI-5, Broken Wire		

 ⁴ Broken wire appears for enabled channels configured as Shutdown only.
⁵ W/A/S = Warning, Alarm or Shutdown depending upon Rudolf R2 configuration.



Address Comli	Address Modbus	Signal	Latched	Comment
507	10328	W/A/S, AI-5	Yes	
517	10336	Start failure	Yes	Failed to start after final start attempt.
527	10344	Stopped	Yes	Engine stopped for no known reason.
537	10352	Overspeed	Yes	Overspeed shutdown.
547	10360	Low voltage	Yes	The start battery, connected to terminals 1 and 2, is below its configured alarm limit.
557	10368	Failed to stop	Yes	Stop command is issued, but engine did not stop.
567	10376	Secondary bat. Failure	Yes	The aux. power source, connected to terminals 3 and 4, is below 12 volts.
577	10384	Current overload	Yes	Short circuit in one of the analogue sensors, or its wiring.
607	10392	Pickup 1 failure	Yes	
617	10400	Common Analogue Sensor Failure	Yes	One or several of the analogue sensors has a broken wire.
636	10415	AI-6, Broken Wire		
637	10416	W/A/S, AI-6	Yes	AK-6 analogue expansion card
646	10423	AI-7, Broken Wire		
647	10424	W/A/S, AI-7	Yes	AK-6 analogue expansion card
656	10431	AI-8, Broken Wire		
657	10432	W/A/S, AI-8	Yes	AK-6 analogue expansion card
666	10439	AI-9, Broken Wire		
667	10440	W/A/S, AI-9	Yes	AK-6 analogue expansion card
676	10447	AI-10, Broken Wire		
677	10448	W/A/S, AI-10	Yes	AK-6 analogue expansion card
706	10455	AI-11, Broken Wire		
707	10456	W/A/S, AI-11	Yes	AK-6 analogue expansion card
717	10464	CAN Diagnosis	Yes	As Switch 1
				Indicates Warning or Alarm status from EMS according to DM1 lamp status.
727	10472	Backup system active	Yes	Indicates failure.
737	10480	Pickup 2 failure	Yes	
747	10488	Sum Broken Wire	Yes	Common alarm for <u>any</u> broken wire, also CAN / J1587. No info about which one.
757	10496	CAN Diagnosis active	Yes	In DCU 305 R3 only



Analogue value status

Comli Address	Modbus Address	Signal	Comment
R2816	42817	Main status	0=Ready
			1=Cranking (Manual Start)
			2=Cranking (Automatic Start)
			3=Running
			4=Cooling
			5=Stopping
			6=Stopped
R2817	42818	Start attempt counter	Displays the current start attempt.
R2818	42819	FSM timer	Seconds. Displays the current timer in the state machine.
R2825	42826	FW version	Firmware: MS-byte is major, LS-byte is minor. Hex.
R2826	42827	HW version	Hardware version
			3=<4.0 4=4.0 12bit 5=4.0 6=4.0 CAN 7=4.1/4.2 8=4.3
R2827	42828	HW type	0 = Auxiliary (DCU 305 A R2) 1 = Propulsion (DCU 305 P R2)
R2828	42829	Engine hours	Total engine hours counter
R2829	42830	Engine latest run	Trip engine hours counter
R2830	42831	Engine starts	Total start attempts counter
R2831	42832	Engine start failures	Total engine start failures
R2832	42833	AI-1	See page 17 for scaling.
R2833	42834	AI-2	See page 17 for scaling.
R2834	42835	AI-3	See page 17 for scaling.
R2835	42836	AI-4	See page 17 for scaling.
R2836	42837	AI-5	See page 17 for scaling.
R2837	42838	Battery voltage	x10 V
R2838	42839	Fuel Rate ⁶	x10 l/h
R2839	42840	Revolution counter	Filtered, x1 RPM
R2845	42846	Buzzer ⁷	Assigns the value 440 (Hz) if any unacknowledged alarm
R2848	42849	AI-6	See page 17 for scaling.
R2849	42850	AI-7	See page 17 for scaling.
R2850	42851	AI-8	See page 17 for scaling.
R2851	42852	AI-9	See page 17 for scaling.
R2852	42853	AI-10	See page 17 for scaling.

 6 Value available in DCU 305 P R2 only. Always zero in DCU 305 A. 7 Available in Firmware >4.21.



Comli Address	Modbus Address	Signal	Comment
R2853	42854	AI-11	See page 17 for scaling.
R2864	42865	AI-12 ⁸	See page 17 for scaling.
R2865	42866	AI-13	See page 17 for scaling.
R2866	42867	AI-14	See page 17 for scaling.
R2867	42868	AI-15	See page 17 for scaling.
R2868	42869	AI-16	See page 17 for scaling.
R2869	42870	AI-17	See page 17 for scaling.

⁸ Channels 12-17 are available on J1587/J1939 channels only.