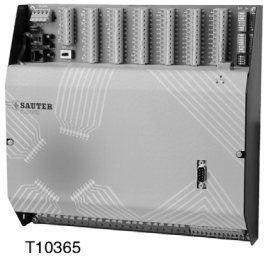
nova220: BACnet compact automation station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This **EYK 220** is the compact **nova220** units of the EY3600 system family equipped with a BACnet communication card (EYK 300). This communication card is used to integrate Sauter's **nova220** automation station with the standardised communication protocol '**BACnet / IP** based on Ethernet' as per **ENV 13321-1**. This **nova220** has communication capability with novaNet and Ethernet and can be networked without any further provisions having to be made. The unit is programmed (parameterised) using a PC with the EY3600 CASE software and the CASE FBD Editor as per IEC 1131-3.
The station has all assemblies and interfaces necessary for operation, for the connection of plant devices and for communication with other stations and with the management level. As a BACnet server, it provides all the objects required for HVAC applications, plus the associated properties with the necessary services. Typical users (BACnet clients) of this information are open management systems, bus-wide operating units, and other automation stations which have BACnet capability etc.. In its function as a BACnet client, the communication card supports peer-to-peer transmission with 'present-value properties' for the specified objects.

Type	Description	Weight [kg]
EYK 220 F001	Compact AS with BACnet interface	3.2

Technical data			
Power supply	230 V~, 50/60 Hz	Perm. ambient temperature	0...45 °C (32...113°F)
Power consumption	28 VA	Storage & transport temp.	–25...70 °C (–13...158°F)
Power loss, max.	approx. 31 W	Permissible humidity	10...90 %rh
Features:			without condensation
Digital inputs	32		
Digital outputs	4 × 0-I	Degree of protection	IP 00 (EN 60529)
	4 × 0-I-II	Protection class	I (IEC 60730)
Analogue inputs	8 × Ni/Pt1000	Ambient class	IEC 60721 3K3
	6 × U/I/R		
Analogue outputs	6 × 0...10 V	Connection diagram	A09735
	(2 × 0...20 mA)	Plug-in card	A09734
Counters	2	Dimension drawing	M04744
Number of BACnet objects	max. 1000 (Total)	Fitting instructions	MV 505788
Number of time programs	max. 100 (Schedule)		
Number of calendars	max. 40 (Calendar)	Factory setting	All switches at 'Off'
Number of historical		Dimensions (W × H × D)	280 × 266 × 78 (mm)
data objects	max. 50 (Trend Log)		11" × 10.5" × 3" (inch)
log data records (Total)	max. 10,000 (Log Buffer)		
Interfaces/communication		Complies with:-	
AS network/novaNet	2 × a/b terminals	Directive 73/23/EEC	EN 60730
	1 × RJ11 socket (6/6)	EMC directive 89/336/EEC	EN 61000-6-1/ EN 61000-6-2
Control Panel EYT 240	1 × RJ45 socket		EN 61000-6-4
nova240 language:			EN 55024
German, French, English, Italian, Dutch, Spanish, Swedish, Norwegian, Danish, Portuguese, Finnish (for other languages, cf. *Accessories)*			EN 55022 Class A
COM interface	DB9 plug as per DTE		
BACnet interface	RJ45-Ethernet		
Transport protocol	BACnet/IP		

Accessories

EYT 240	Control panel, **nova240**
0501112 002	**nova220** microprograms with **nova240** language: German, French, English, Polish, Slovenian, Hungarian, Romanian, Russian, Czech, Turkish
0367842 002	Connecting cable, **nova** AS – **nova240**, 1.5 m (4.9 ft)
0367842 003	Connecting cable, **nova** AS – **nova240**, 2.9 m (9.5 ft)
0367842 004	Connecting cable, **nova** AS – **nova240**, 6.0 m (19.7 ft)
0367862 001	**novaNet** connecting cable, **novaNet 290** or **novaNet 291** – AS, 1.5 m (4.9 ft)
0367862 002	**novaNet** connecting cable, **novaNet 290** or **novaNet 291** – AS, 2.9 m (9.5 ft)
0367862 003	**novaNet** connecting cable, **novaNet 290** or **novaNet 291** – AS, 6.0 m (19.7 ft)
0367862 004	Connecting cable, **novaNet** RJ11-RJ11, 0.21 m (supplied)
0367883 002	5 × EPROMs (empty) (USER-EPROM)
0367888 001	5 × EPROMS (4 Mbit; empty)
0386301 001	Connecting cable, COM DB9-DB9, 3 m

Engineering notes

The **nova220** automation station can be fitted in a panel using a top-hat rail (EN50022).
The EYK 220 F001 station is powered with 230 V~.
The earthing terminals are connected to ground (PE) and to the housing.
The connection from the BACnet communication card to the automation station is integrated via **novaNet**. The supplied cable (367862 004) should be connected to the RJ11 socket.
The Ethernet link is made via an RJ45 socket. Communication is effected via the BACnet/IP transport protocol.
The configuration of this IP address and other parameters is effected via the Sauter software module 'BACnet Server Configurator'. See BACnet manual 7001007 003.
The BACnet communication card implements the 'BACnet Server/Client functionality' in Sauter DDC type **nova220.**
The MFAs (machine fine addresses) used in the automation station are converted – when the house address (data points) has been projected – into 'BACnet objects', whereby the management and updating of the relevant BACnet object list are done automatically. This means that there is no additional generating needed in order to integrate the BACnet functionality at DDC level.
Using the similarly implemented Scheduler (day and week calendar) and the associated 'Schedule and Calendar BACnet objects', it is possible to process local BACnet time programs and also, therefore, to control process variables of the connected AS in accordance with a time programme.

The DDC data points can be transmitted either by BACnet clients via cyclical polling or by the COV (Change Of Valve) subscription mechanism on the BACnet communication card.

Others BACnet specifications, as per separate BACnet PICS (Protocole Implementation Statement) specification. See document „Sauter-Server-EY3600-PICS.pdf"

The plant devices are connected via spring-type terminals. The following conditions must be observed:-

Cable size:	min. 0.8 mm² (AWG 18), max. 2.5 mm² (AWG 13), adhering to the norms
novaNet:	with twisted cable
Digital inputs:	potential-free contacts, opto-coupler, transistors (open collector)
Digital outputs:	< 250 V~ / 2 (2)A to the relay contacts
Analog inputs:	< 10 V =
Analog outputs:	no extraneous voltage
Counters:	potential-free contacts, opto-coupler, transistor (open collector)

Description of inputs and outputs

Temperature measurement

Number of inputs	8
Type of inputs	Ni1000 (without coding) Pt1000 (software coding)
Measuring ranges:-	
Ni1000	–50...+150 °C (–58...+302°F)
Pt1000	–100...+500 °C (–148...+932°F)

Linear-correction factors *a* and *b*:	(Y = a X + b)
Slope *a*	No entry is needed here. A proportional factor, which gives the result in °C, can be called up direct from the microprogram.
Zero-point shift *b*	No calibration is needed here. A line resistance of 2 Ω is included and has been compensated for. If the line resistance R is greater (deviation > 2 Ω):- b = –0.18 × (R - 2 Ω) in room-temperature range or b = –0.16 × (R - 2 Ω) at approx. 100°C

The eight inputs, which do not need calibrating, already take the resistance of the cable into account and can be used for Ni1000 and Pt1000. The sensors are connected using two-wire technology; the connecting leads can be up to 55 m (180 ft) long if 0.8 mm² (AWG 18) or 170 m (558 ft) if 1.5 mm² (AWG 15). The measuring voltage is pulsed in order to prevent the sensor from warming up.
The inputs are intended for Ni1000 sensors. Due to the linearisation, a deviation of only 0.06 °C is attained. Pt1000 sensors can also be used.
The type of measurement can be chosen via the software.

The linearisation for Pt1000 guarantees negligible error between –50 and +100 °C (–58...212°F).

For the full measuring range of the Pt1000, see the following table:-

Temperature		**Absolute difference**	
–100 °C	(–148°F)	–0.05 °C	(–0.09°F)
–50 °C bis +100 °C	(–58...212°F)	< ± 0.02 °C	(± 0.04°F)
+150 °C	(302°F)	+0.05 °C	(+0.09°F)
200 °C	(392°F)	+0.11 °C	(+0.2°F)
300 °C	(572°F)	+0.29 °C	(+0.52°F)
400 °C	(752°F)	+0.10 °C	(+0.18°F)
500 °C	(932°F)	–0.31 °C	(–0.56°F)

U/I/R measurement

Number of inputs	6
Type of inputs	3 × U/I/R
	3 × U/I
Voltage	0 (2)...10 V
	0 (0,2)..1 V
Current	0 (4)...20 mA
Potentiometer	0 to 500 Ω...2 kΩ

Linear-correction factors *a* and *b*: (Y = a X + b)
The linearity can be adapted very accurately for every input.

Settings for a standardised signal (0...1)

Linear-correction factors		**Inputs**
a	b	
1	0	0...10 V
10	0	0...1 V
1	0	0...20 mA
20	0	0...1 mA
1.25	–0.25	2...10 V
1.25	–0.25	4...20 mA
12.5	–0.25	0.2...1 V

Input limit values:	
Measurement of voltage	< ± 50 V
Measurement of current	< 50 mA
Loading of reference outputs	< 10 mA
Return line for all signals:	earth
Accuracy:	U = ± 0.1% (± 0.01 V)
	I = ± 0.1% (± 0.02 mA)
	R = ± 0.5% (± 0.05 V)
Resolution:	U = 5 mV

Measuring the voltage (U)
Voltage can be measured at all 6 inputs. The voltage is measured between one of the input terminals for voltage (marked with a 'U') and an earth terminal. The signal must be potential-free. The two measurements 0 (0.2)...1 V and 0 (2)...10 V are selected via the software.
The maximum voltage without damage being incurred is < ± 50 V. The visible range, however, is limited to 10 V. The internal resistance R_i of the input (load) is 60 kΩ in this case.

Measuring the current (I)
Current can also be measured at all 6 inputs. There are special terminals (marked with an 'I') available for measuring the current. The current signal must also be potential-free. The maximum input current must be limited to 50 mA. The internal resistance R_i is 100 Ω.

Measuring the resistance (R)
The potentiometer is connected to terminals U, earth and +1 V; the use of all six measurement inputs requires that the reference outputs are doubly occupied. The +1 V reference voltage is pulsed. In order not to overload the reference outputs, the lowest potentiometer value should not be less than 500 Ω, even if parallel circuited in the case of double occupation. The reference output is protected against short circuits. The potentiometer's upper value of 2 kΩ is prescribed in order to guarantee stable measurements free of interference.

Pulse metering

Number of inputs	2
Type of inputs	potential-free contacts opto-coupler transistor (open collector)
Input frequency	< 15 Hz
Max. output current of the inputs	0.7 mA with respect to earth
De-bounce time	20 ms
Protected against extraneous voltage	up to 24 V ac/dc

Potential-free contacts, opto-couplers or transistors with open collectors can be connected to the meter inputs. The maximum pulse frequency is 15 Hz.
A de-bounce time of 20 ms is envisaged so that the switching contacts are correctly received. The pulse is received on the falling flank and can remain present indefinitely. The automation station's internal counter value is interrogated every cycle and stored in DW 2 as a dual partial sum. The summation to form the actual counter value is done by the software after 30s at the latest via the station's processor in DW 6. Through using the FP format, the counter value can have a maximum of approx. 2.147×10^9.
With the FP format, it is possible to show counter values up to 67,108,864 with a resolution of 1.
Any counter overflow can be curbed by resetting using the 'C_Preset' function module.

Digital inputs

Number of inputs	32
Type of inputs	potential-free contacts, with respect to earth opto-coupler transistor (open collector)
Max. output current of the input	0.7 mA with respect to earth
De-bounce time	20 ms
Protected against extraneous voltage	up to 24 V a.c./d.c.

The **nova220** station processes 32 items of digital information. The monitored inputs are connected between the input terminals and earth. The station applies a voltage of approx. 24 V to the terminal. When the contacts are open, this corresponds to bit=0. When the contacts are closed (equivalent to bit=1), a current of approx. 1 mA flows at 0 V. Brief changes of 30 ms (at the shortest) between the station's queries are first placed in the buffer and then processed at the next cycle.

It is possible to decide separately for each input whether it should be defined as an alarm or a status input.

Digital outputs

Number of outputs	$4 \times$ 0-I $4 \times$ 0-I-II
Type of outputs	relays
Outputs' loading	250 V~ / 2 (2)A

The digital outputs can also be used as $8 \times$ 0-I.
The feedback signals can be received (exclusively genuine) via the digital inputs.

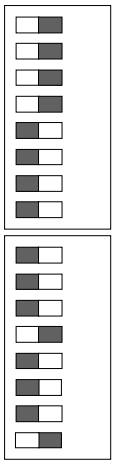
Analogue outputs

Number of outputs	6
Type of outputs	$4 \times$ 0(2)...10 V d.c., 20 mA max. $2 \times$ 0(2)...10 V or 0...20 mA

The output voltage is tapped between the relevant output terminal and an earth terminal. Two outputs can provide 0..20 mA. The outputs are protected against static discharges, but not against local alternating or direct current, which can destroy the protective diode and the output driver. For this reason, the plant device (e.g. a valve drive) should always be connected in the plant first. Then a check should be made at the station to ensure that there is no potential at all (i.e. 0 V) at both wires with respect to earth and with respect to each other. If this is the case, the earth lead should be connected first and the signal lead last to their respective terminals in the station.

The **nova220** automation station has a fast operating program which reads in all inputs, processes the parameterised modules, updates the outputs and carries out the necessary communication with other stations or with visualisation PCs.
A real-time clock for the time programmes is also integrated in the automation stations.
A lithium battery ensures that the user data (FBD data), time programmes and historical data (HDB) are retained in the SRAM in the event of a power failure. The real-time clock also runs off this lithium battery.
The battery makes it possible to retain the data and run the real-time clock for at least 10 years without power applied.
Date and time are set ex works.
When power is restored, the automation station checks the consistency of the data and starts communication.
The user programmes can be loaded from any point in the novaNet. The data stay in the battery-backed SRAM even in the event of a power failure. In addition, the data can be stored captive in a user EPROM. Therefore, the level of protection against loss of data is very high.
Every station needs an AS address (0...28671), which is set via coding switches.
The station is programmed (control loops and parameters) via the **novaNet** automation network. The data are then stored in a battery-backed memory. The battery's serviceable life is at least ten years.
The data can be saved permanently by means of the USER-EPROM.
Every station needs an AS address, which is set via coding switches.

Putting into operation
When connecting the power supply, the earthing lead must be connected to the screw terminal provided (protection class I).
When working on the units, the power supply must be disconnected.
Before being linked to the **novaNet**, each station must be given a clear (unique) address. This station number is binary-encoded via the block of DIP switches and can be between 1 and 4194 (for the BACnet stations).



Value	Off	On	
1		×	1
2		×	2
4		×	4
8		×	8
16	×		
32	×		
64	×		
128	×		
256	×		
512	×		
1024	×		
2048		×	2048
4096	×		
8192			
16384	×		
Even Parity		×	

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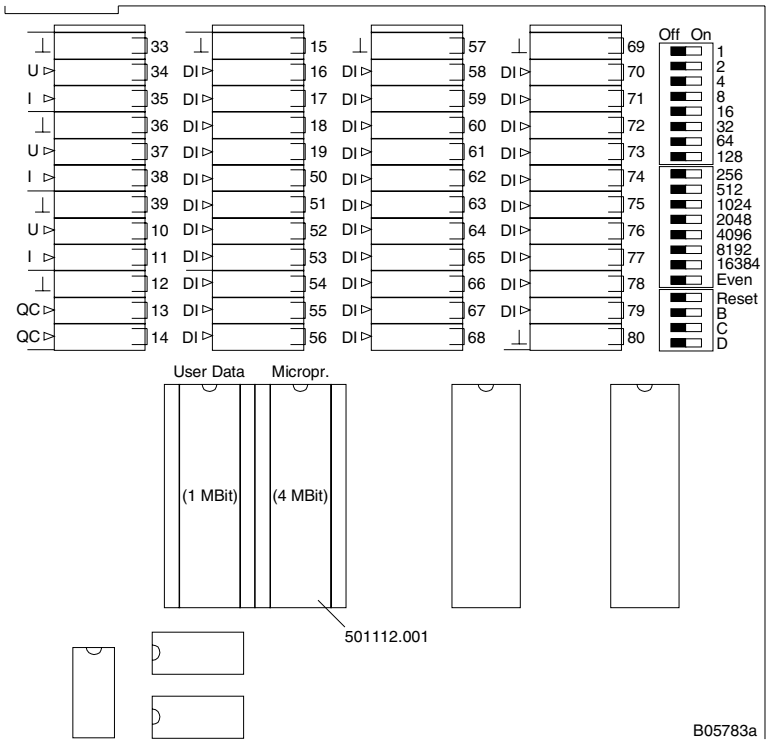
The AS address is set by means of the 16-digit switch-blocks. The last switch is for setting the parity, which refers to the address and not to the four other switches situated below. The parity should be set so that the number of switches in the 'on' position, including parity, is even.

Example:
2048 + 8 + 4 + 2 + 1 = 2,063

The following example is intended as an explanation of the binary encoding: Station number 2,063
This AS number fort he EYK220F001 has to be set between 1 and 4,194

If the station has not already got an EPROM with the parameterised user data, they must be transmitted to the station. Communication is always performed via the **novaNet** EY3600 bus and the corresponding terminals or the RJ-11 connector. Programming can be done in parallel to the data traffic, though this may lengthen the response time of the other network subscribers. For this reason, the station can be separated from the **novaNet** for the duration of the data transfer and the 'parameterising' PC can be connected locally. After the data transfer has been complete, the data are immediately active. The station can then be re-connected to the network and is ready for operation.
You are strongly advised to copy the user data in an EPROM, which can be loaded with any normal programming device and put into the station.
This greatly increases security and simplifies fault-finding.

nova220



Before being opened, the station must be removed from the power supply! Protective measures to prevent electrostatic discharges must be taken before performing any work on integrated circuits. The station must then be reset using the reset switch.

Reset:

The reset switch is set to 'ON' for approx. ½ s, causing the station to load the user data from the EPROM and to start operation under defined starting conditions.

If the reset switch is left in the ‘ON’ position, the station remains in the reset mode and cannot function correctly.
All versions have in the top left-hand corner three LEDs which indicate the status of the automation station. The green LED, at the top, indicates that the power supply is on when lit continuously; the two yellow LEDs indicate telegram traffic in both directions on the **novaNet**. If the station has stopped or a fault has been detected in the RAM, the watchdog detects this and the station is then restarted with the EPROM data. In this case, no telegrams are sent to the exterior for a brief period, so the yellow 'Send' LED (at the bottom) no longer flashes. If this LED does not light up, it means that the EPROM is either the wrong one or is faulty, or that no EPROM has been inserted. In this case, the station is no longer operable. In stand-alone mode (without **novaNet**), the 'Receive' LED (in the middle) remains unlit; the 'Send' LED flashes quickly (approx. 7 times per second), since a dummy telegram is sent each cycle.
If the station is reset manually, the microprogram and the user data are also read in afresh. As soon as this has been done, the yellow 'Send' LED again flashes in time to the outgoing telegrams.

LED display for Ethernet interface

Speed	yellow	Data transmission speed; is recognised automatically:- LED off: 10 Mbits / s LED on: 100 Mbits / s
LI	yellow	Physical link established (Link)
ACT	yellow	Transmission of BACnet protocol (Activity)

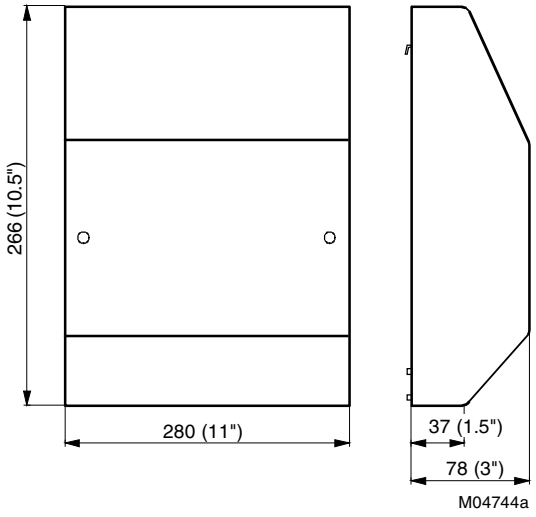
Relationship between MFAs and terminals:

nova220 connection	**MFA**	**Bit**	**Code**	**Terminals**			
Ni1000/Pt1000				**GND**	**Input**		
	00		51	5	6		
	01		51	7	8		
	02		51	9	10		
	03		51	11	12		
	04		51	13	14		
	05		51	15	16		
	06		51	17	18		
	07		51	19	20		
Analogue input				**GND**	**U/R**	**I**	+1 V Ref.
U/I/R	08		50	21	22	23	24
U/I/R	09		50	25	26	27	28
U/I/R	10		50	29	30	31	32
U/I/R	11		50	33	34	35	
U/I/R	12		60	36	37	38	
U/I/R	13		60	39	40	41	
Analogue output				**GND**	**U**		**I**
0-10 V	20		82	122	123		
0-10 V	21		82	122	124		
0-10 V	22		82	125	126		
0-10 V	23		82	125	127		
0-10 V or 0-20 mA	24		81	128	129		130
0-10 V or 0-20 mA	25		81	131	132		133
Digital output				**COM**	**I**		**II**
0-I	32		20	102	103		
0-I	33		20	104	105		
0-I	34		20	106	107		
0-I	35		20	108	109		
0-I-II	36		20	110	111		112
0-I-II	37		20	113	114		115
0-I-II	38		20	116	117		118
0-I-II	39		20	119	120		121
Pulse counter				**GND**	**Input**		
	50		C1	42	43		
	51		C1	42	44		
Digital input				**GND**	**Input**		
	52-1	24	10		46		
	52-2	25	10	45/	47		
	52-3	26	10	57/	48		
	52-4	27	10	69/	49		
	52-5	28	10	80/	50		
	52-6	29	10		51		
	52-7	30	10		52		
	52-8	31	10		53		

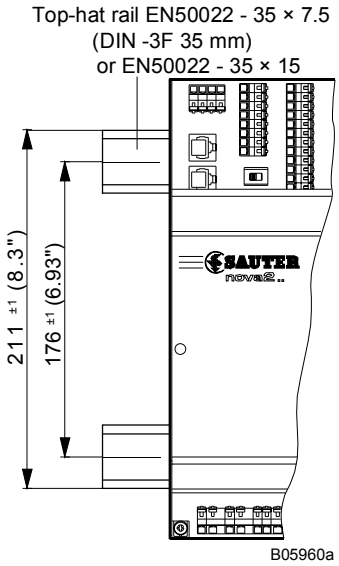
nova220 connection	MFA	Bit	Code	Terminals	
Digital input				**GND**	**Input**
	53-1	24	10		54
	53-2	25	10		55
	53-3	26	10	45/	56
	53-4	27	10	57/	58
	53-5	28	10	69/	59
	53-6	29	10	80	60
	53-7	30	10		61
	53-8	31	10		62
	54-1	24	10		63
	54-2	25	10		64
	54-3	26	10	45/	65
	54-4	27	10	57/	66
	54-5	28	10	69/	67
	54-6	29	10	80	68
	54-7	30	10		70
	54-8	31	10		71
	55-1	24	10		72
	55-2	25	10		73
	55-3	26	10	45/	74
	55-4	27	10	57/	75
	55-5	28	10	69/	76
	55-6	29	10	80	77
	55-7	30	10		78
	55-8	31	10		79

Earth connection

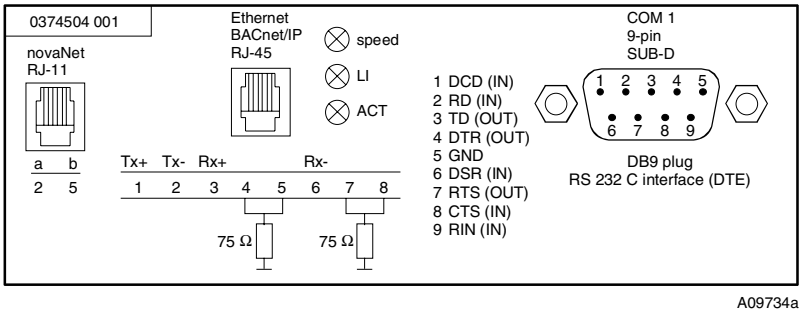
Dimension drawing



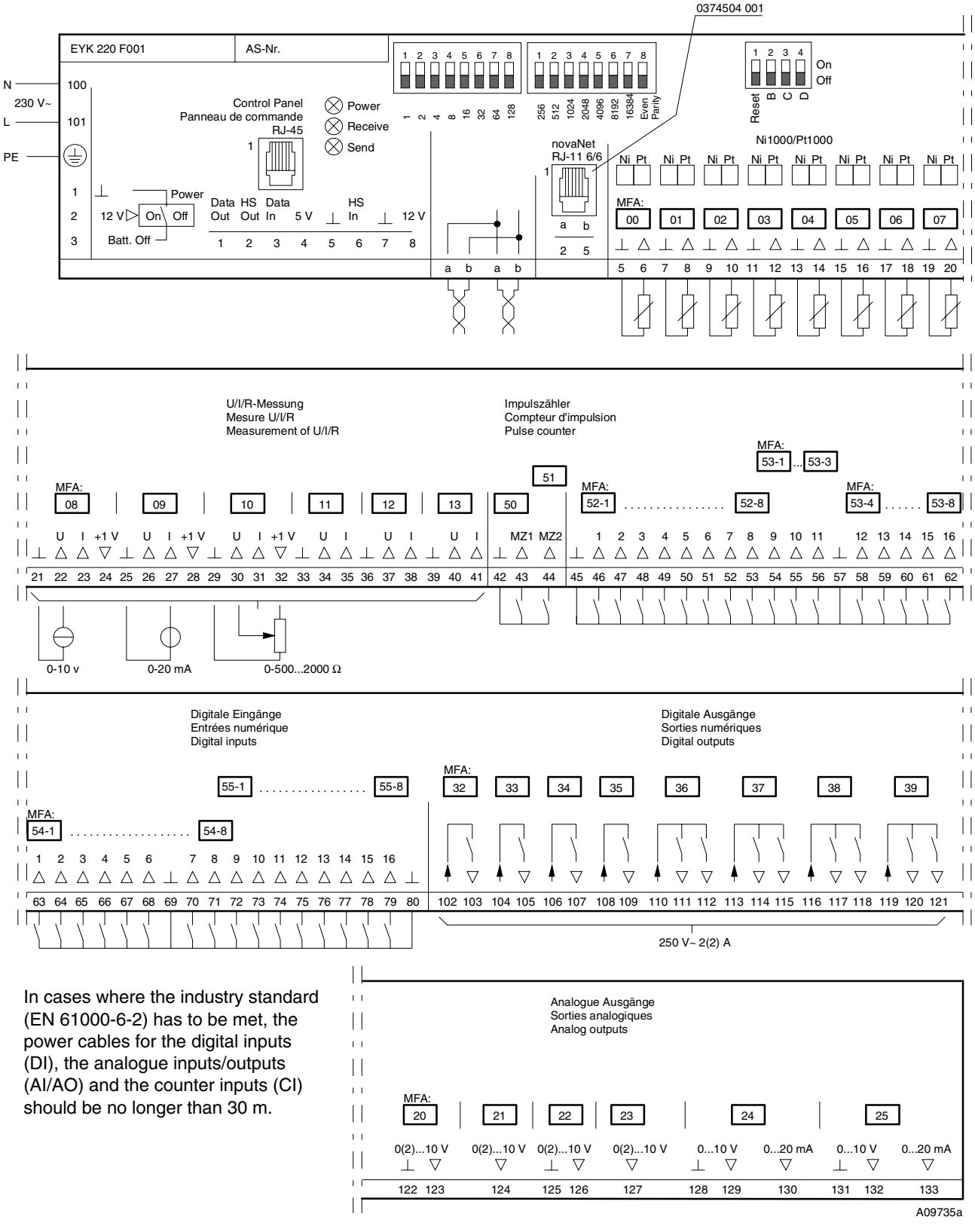
Fitting to top-hat rail



Wiring diagrams



Wiring diagrams (continued)



In cases where the industry standard (EN 61000-6-2) has to be met, the power cables for the digital inputs (DI), the analogue inputs/outputs (AI/AO) and the counter inputs (CI) should be no longer than 30 m.

Printed in Switzerland

N.B.: A comma between cardinal numbers denotes a decimal point

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Sauter Systems