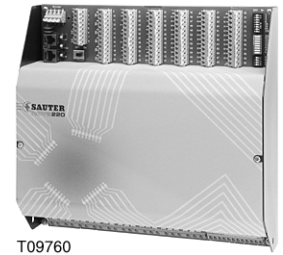


nova220: Compact automation station with BACnet interface

This **EYK 220 F001** is the compact **nova220** units of the EY3600 system family equipped with a BACnet communication card. This communication card is used to integrate Sauter's **nova220** automation station with the standardised communication protocol 'BACnet 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 objects stated below.



T09760

Type	Description	Weight [kg]
EYK 220 F001	Compact AS with BACnet interface	3.2
Technical data		
Power supply	230 V~, 50/60 Hz	Ambient temperatures:- in operation 0...45 °C (32...113°F)
Power consumption	24 VA	Storage and transport temp. -25...70 °C (-13...158°F)
Power loss, max.	approx. 27 W	Ambient conditions
Features:		Humidity 10...90 %rh without condensation
Digital inputs	32	Degree of protection IP 00 (EN 60529)
Digital outputs	4 × 0-I 4 × 0-I-II	Protection class I (IEC 60536)
Analogue inputs	8 × Ni/Pt1000 6 × U/I/R	Ambient class IEC 60721 3K3
Analogue outputs	6 × 0...10 V (2 × 0...20 mA)	Connection diagram A09735/A09734
Counters	2	Dimensions (W × H × D) 280 × 266 × 78 (mm) 11" × 10.5" × 3" (inch)
Number of BACnet objects	max. 1000	Dimension drawing M04744
Number of time programs	max. 100	Fitting instructions MV 505788
Number of calendars	max. 40	Factory setting All switches at 'Off'
Interfaces/communication		
AS network/novaNet	2 × a/b terminals 1 × RJ-11 socket (6/6)	CE conformity
Control Panel EYT 240 F001	1 × RJ-45 socket	as per (73/23/EWG) EN 60730
nova240 language:	Deutsch, Français, English, Italiano, Nederlands, Espanol, Svenska, Norsk, Danish, Portugues, Suomi (for other languages, cf. <i>Accessories</i>)	as per (89/336/EWG) EN 50081-1 EN 50081-2 EN 50082-1 EN 50082-2
COM interface	DB9 plug as per DTE	
BACnet interface	RJ45-Ethernet	
Transport protocol	BACnet/IP	

Accessories

EYT 240 F001	Control panel, nova240
501112 002	nova220 microprogram with nova240 language:- Deutsch, Français, English, Polski, Slovenská, Magyar, Russian, Cesky, Türkiye
367842 002	Connecting cable, nova AS – nova240 , 1.5 m (4.9 ft)
367842 003	Connecting cable, nova AS – nova240 , 2.9 m (9.5 ft)
367842 004	Connecting cable, nova AS – nova240 , 6.0 m (19.7 ft)
367862 001	novaNet connecting cable, novaNet 290 or novaNet 291 – AS, 1.5 m (4.9 ft)
367862 002	novaNet connecting cable, novaNet 290 or novaNet 291 – AS, 2.9 m (9.5 ft)
367862 003	novaNet connecting cable, novaNet 290 or novaNet 291 – AS, 6.0 m (19.7 ft)
386301 001	Connecting cable, COM DB9-DB9, 3 m
367862 004	Connecting cable, novaNet RJ11-RJ11, 0.21 m (supplied)
367862 005	Software module ' BACnet server configurator '
367883 002	5 × EPROMs (empty) (USER-EPROM)
367888 001	5 × EPROMS (4 Mbit; empty)

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 such as time synchronisation, BACnet device address and PC address is effected via the Sauter software module 'BACnet Server Configurator', using the COM connecting cable and the DB9 connector.

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.

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

Cable size:	min. 0.8 mm ² (AWG 18), max. 2.5 mm ² (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)

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 +150 °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		Inputs
a	b	
1	0	0...10V
10	0	0...1V
1	0	0...20 mA
20	0	0...1 mA
1,25	-0,25	2...10V
1,25	-0,25	4...20 mA
12,5	-0,25	0,2...1V

Input limits:

Measurement of voltage	< ± 50 V
Measurement of current	< 50 mA
Loading of reference outputs	< 10 mA

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 .

Digital inputs

Number of inputs	16
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 × 0-I 4 × 0-I-II
Type of outputs	relays
Outputs' loading	250 V~ / 2 (2)A

The digital outputs can also be used as 8 × 0-I.

The feedback signals can be received (exclusively genuine) via the digital inputs.

Analogue outputs

Number of outputs	6
Type of outputs	4 × 0(2)...10 V d.c., 20 mA max. 2 × 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.

Implemented BACnet PICS and BIBBs

PICS: Protocols Implementation Conformance Statement

BIBBs: BACnet Interoperability Building Blocks

- **Conformance Class: Class 1 to 4:**

- **Supported objects**

The following BACnet object types described in the ASHRAE Standard BACnet 135-1995 have been implemented:-

- Description of the main device features
 - Device object
- Portrayal of the process values:-
 - Analogue, multi-state and binary-input object
 - Analogue, multi-state and binary-output object
 - Analogue, multi-state and binary-value object
- Handling of weekly and exceptional programmes
 - Scheduler object
 - Calendar object
- Time- and recipient-dependent event and alarm distribution in the system
 - NotificationClass object

The editing capacity with regard to 'BACnet objects' per EYK 220 F001 is 1000 'objects', including Calendar and Schedule objects.

- **Supported services**

Event-controlled transmission of the actual value and other process variables is possible using the BACnet Services Change-Of-Value Reporting and Intrinsic-Reporting.

Supported services	Initiate	Execute
Acknowledge Alarm		X
Confirmed COV Notification	X	X
Confirmed Event Notification	X	
Get Alarm Summary		X
Subscribe COV	X	X
Unconfirmed COV Notification	X	X
Unconfirmed Event Notification	X	
Add List Element		X
Remove List Element		X
Read Property	X	X
Read Property Multiple		X
Write Property	X	X
Write Property Multiple		X
Device Communication Control		X
Time Synchronisation		X
Who-Has		X
I-Have	X	
Who-Is		X
I-Am	X	

Structure of a BACnet object

A BACnet object comprises a collection of parameters (properties), which are either obligatory, optional or author-specific. The following properties are obligatory and can be found in every BACnet object:-

- Object_Identifier
- Object_Name
- Object_Type

These properties must be unambiguous in a BACnet system.

Portrayal of MFA to BACnet objects

An MFA of an AS is always portrayed to exactly one instance of the corresponding BACnet object type. The instance number of such a BACnet object is worked out from the AS novaNet address (0...4194) and the MFA number as follows:-

$$\text{Object instance} = \text{AS address} * 1000 + \text{MFA number}$$

The link to the EY3600 input/output modules is shown in the BACnet object-type table below.

BACnet Object-Type	Code	EY3600 input/output modules	Fonction
Analog Input	0	AI, CI, AI_Soft, CIF_Soft, CIV_Soft	Measure / counter
Analog Output	1	AO	Positioning
Analog Value	2	AI_Soft, AIA_Soft, CFB_Soft	Setpoint
Binary Input	3	BI, BI_Soft, DI, DI_Soft	Alarm / State / BFB 0-I
Binary Output	4	DO	Command 0-I
Binary Value	5	DI_Soft, DIA_Soft, CFB_Soft	Command 0-I
Multistate Input	13	DI, DI_Soft	BFB 0-I-II-...
Multistate Output	14	DO	Command 0-I-II-...
Multistate Value	19	DI_Soft, DIA_Soft, CFB_Soft	Command 0-I-II-...

Example of BACnet object parameter

BACnet properties	Property data type	Link to EY3600 parameter
Object_Identifier	BACnetObjectIdentifier	AS address *1000 + MFA number
Object_Name	CharacterString	House address (HA)
Object_Type	Code	0.1...20
Present_Value	REAL or flag	Output (Y, fC or cC)
Description	CharacterString	Address text (ATxt)
.	.	.
.	.	.
.	.	.

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. 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 0 and 4194 (for the BACnet stations).

Off	On	Wert	Off	On	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	1		x	1
<input type="checkbox"/>	<input checked="" type="checkbox"/>	2		x	2
<input type="checkbox"/>	<input checked="" type="checkbox"/>	4		x	4
<input type="checkbox"/>	<input checked="" type="checkbox"/>	8		x	8
<input checked="" type="checkbox"/>	<input type="checkbox"/>	16	x		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	32	x		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	64	x		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	128	x		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	256	x		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	512	x		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1024	x		
<input type="checkbox"/>	<input checked="" type="checkbox"/>	2048		x	2048
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4096	x		
<input type="checkbox"/>	<input checked="" type="checkbox"/>	8192		x	8192
<input checked="" type="checkbox"/>	<input type="checkbox"/>	16384	x		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Even	x		
<input type="checkbox"/>	<input type="checkbox"/>	Parity			

B04723

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:

$$8192 + 2048 + 8 + 4 + 2 + 1 = 10255$$

The following example is intended as an explanation of the binary encoding: Station number 10,255

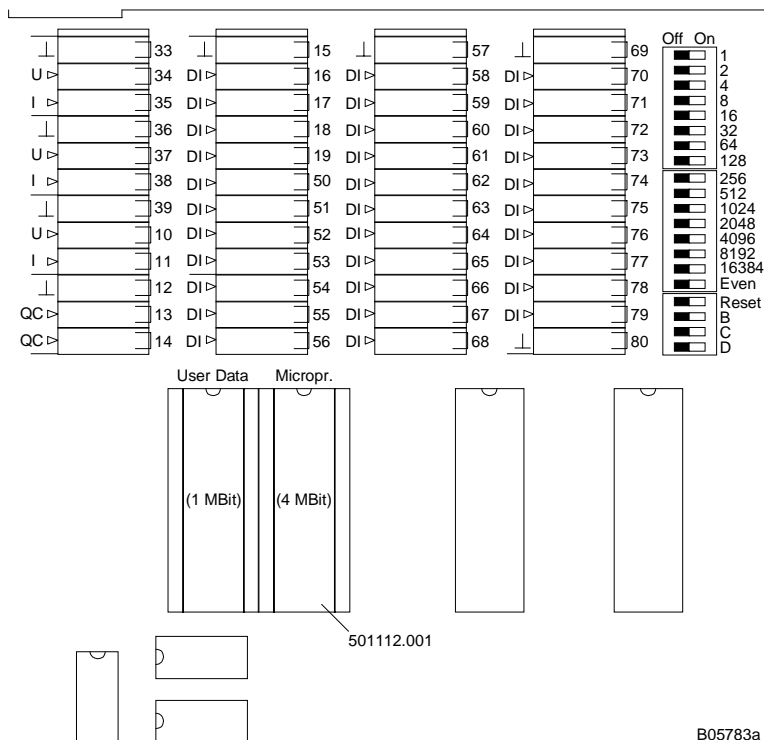
But this number is limited to 4194 for the EYK 220 F001.

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.

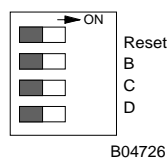
This greatly increases security and simplifies fault-finding.

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.

The **BACnet communication card** must be configured once only.
 The card's hardware platform supports the Windows CE operating system, Version 3.0.
 The configuration is transmitted via the COM interface and stored there (protected against power failure) in a flash memory.
 This is parameterised using the **Sauter software tool 'BACnet Server Configurator'**.

Configuration

- **Device number and name**
- **Number of 'Schedule objects' (time profile) and 'Calendar objects'**
- **Time synchronisation**

The system is not time-synchronised on starting. Synchronisation can be effected either by reading the time from a **nova220** or by performing the BACnet time synchronisation of a BACnet time master. Synchronisation via a BACnet time master has priority.

- **IP address**

For communication with other BACnet devices (BACnet clients), an Ethernet net-work interface is used. Communication is via the transport protocol BACnet IP.

The EYK 220 F001 needs an IP address.

- **EY3600 PC address:**

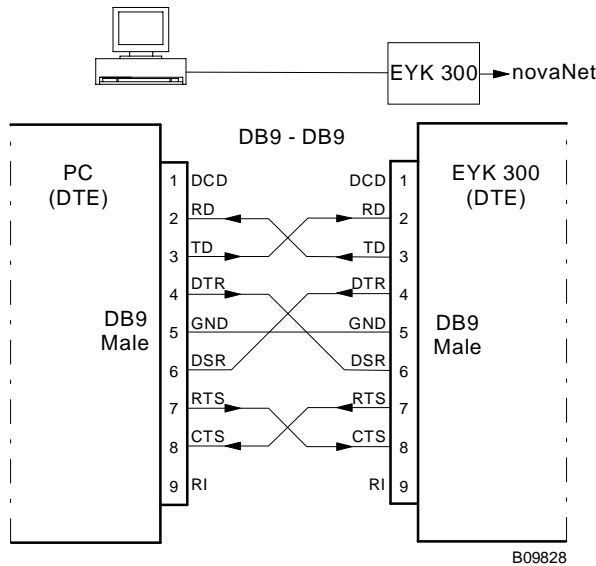
The link to the automation station is via the **novaNet**. For this, there is an EYS290-compatible interface integrated on the printed circuit board.

The EYK 220 F001 needs a novaNet address (31744...31999).

- **System number (0 ... 7)**
- **Integrate AS addresses**

Connection between PC and EYK 300 F001 for the above configuration

The cable used is identical to the **novaNet291** router cable (MZ. 368301.001).
 The communication parameters between the PC and the **BACnet communication card** must be set to the standard settings (9600 Bd, 8 bits, without parity, 1 stop bit, without handshake).




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)

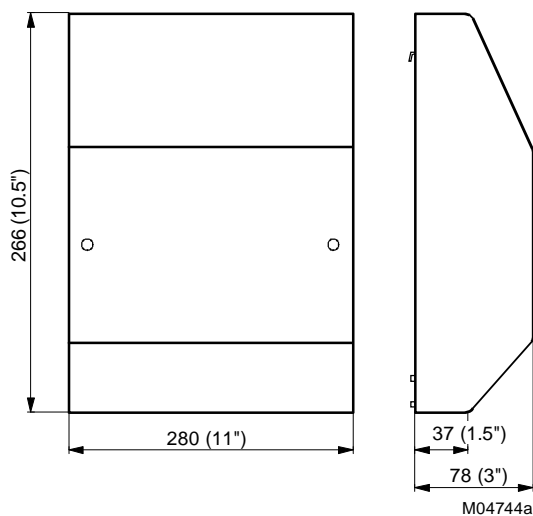
Relationship between MFAs and terminals

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	+1V Ref.
U//R	08		50	21	22	23	24
U//R	09		50	25	26	27	28
U//R	10		50	29	30	31	32
U//R	11		50	33	34	35	
U//R	12		60	36	37	38	
U//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		

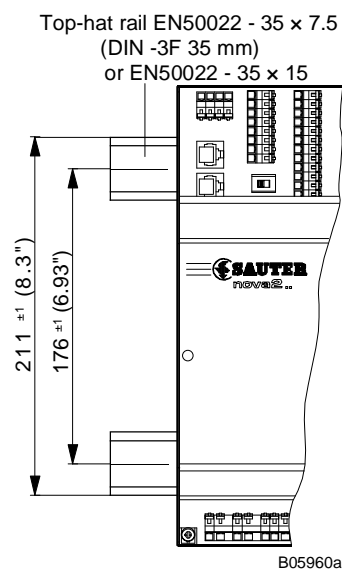
nova220 connection	MFA	Bit	Code	Terminals	
Digital input				GND	Input
	53-1	24	10	45/ 57/ 69/ 80	54
	53-2	25	10		55
	53-3	26	10		56
	53-4	27	10		58
	53-5	28	10		59
	53-6	29	10		60
	53-7	30	10		61
	53-8	31	10		62
	54-1	24	10	45/ 57/ 69/ 80	63
	54-2	25	10		64
	54-3	26	10		65
	54-4	27	10		66
	54-5	28	10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

 Earth connection

Dimension drawing



Fitting to top-hat rail



Wiring diagrams

