Hybrid recorders
VARIOGRAPH

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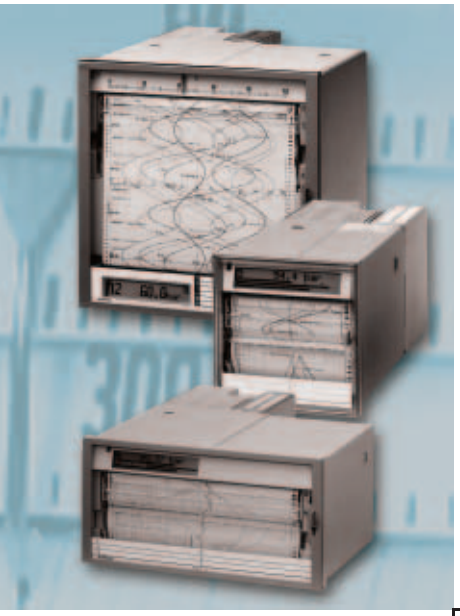


Summary

3

	VARIOGRAPH 7ND3560 Page 3/7	VARIOGRAPH 7ND3590 Page 3/7	VARIOGRAPH 7ND3521 Page 3/7
Format	288 x 288	288 x 144	144 x 144
Class		0.5	
Microprocessor-based		■	
Analog inputs		3, 6 or 12	
Digital inputs/outputs		6/8	
Inputs		Plug-in modules	
Measured variable Current		DC	
Voltage		DC	
Temperature		Thermocouple	
		Resistance thermometer	
Resistance		■ (2- or 3-wire)	
Measuring ranges		Freely-programmable	
Operating modes		Display, curves, tables	
Recording method		Fiber pen	
Chart paper	Roll	Roll	Roll or fanfold pack
Recording width	210 mm	210 mm	100 mm
Number of colors		6	
Text printout		■	
Scale printout		■	
Date and time printout		■	
Alarms		2 per channel, freely-programmable	
Math. functions		■	
Alarm text		Per channel	
Alarm linking		■	
Zooming		■	
Zoning		■	
Remote operation		■	
Remote control		–	
PC connection		■	
Line recorder function		Dot-joining	
Pen offset		Compensated	
Interface		Serial	
Storage (measured values)		Short-term	
Power supply		AC 24 or 110 to 240 V DC 24 or 110 to 230 V	
Operator prompting		De/En/Fr	
Mounting		Sheet-steel panel, desk upright panel, cabinet	
		Panel with 72 x 72 grid	
Installation without interspacing		■	

The range of flush-mounted recorders – 3 standardized formats – comprises 3 hybrid recorders which can record texts and the date and time in addition to printing curves and tables of measured values.

Fiber pens are used for recording. All recorders are characterized by a robust design and programmable parameters. The recording is largely independent of the position, and the recorders are easy to service.

Recording method

With the fiber pen recording, the reservoir and fiber tip are combined in one assembly. Violet, red, black, green, blue and brown pens are available for the VARIOGRAPH hybrid recorders.

VARIOGRAPH recording method

The VARIOGRAPH recorders operate according to a discontinuous recording method.

The values are measured using a short scanning cycle, stored in intermediate memory, and output channel-by-channel within one recording cycle with a max. recording length of 5 mm.

If
- highly oscillating signals with a large amplitude (approx. $^2/_3$ of the chart width) and/or
- long character strings such as texts and measured-value tables

have to be output over a longer period, the maximum possible output speed of the recording system is insufficient.

To prevent the loss of measured values with such types of signal – which are not typical for process engineering applications – the maximum chart speed should not be set. It is additionally recommendable to omit simultaneous use of all properties of the recorders in such cases, especially the output of texts and tables.

Design

Sheet-steel housing, ergo gray (RAL 7032) or dust gray (RAL 7037)

7ND3521:
Plastic front door with matt border, with spring-loaded latch or with spring-loaded latch and lock.

7ND3590, 7ND3560:
Front door with lock and glass pane, front frame dust gray (RAL 7037).

Frame width:
7.5 mm/12 mm (housing format 288 x 144)
9 mm/15 mm (housing format 288 x 288)

Front dimensions to DIN 43831.
Dimensions and panel cut-outs are specified with the respective recorders.

Technical explanations

Error limits and interference suppression

The recorders comply with class 0.5 of the regulations for electrical measuring instruments. Any differences are listed in the Technical data.

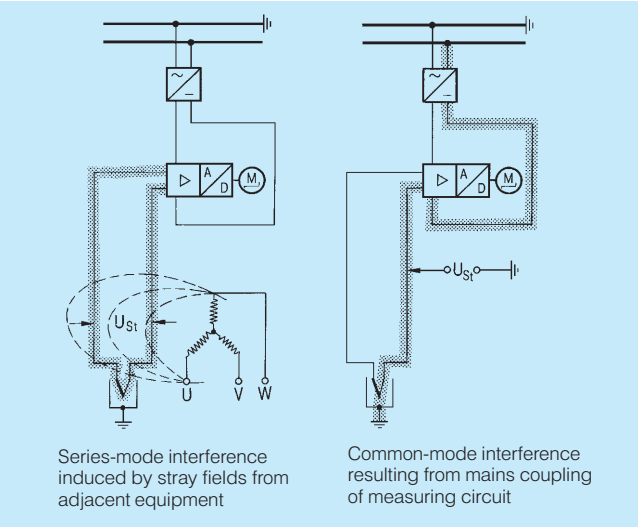
The interference suppression St_U is specified in decibels. It is determined according to the following equation:

$$St_U = 20 \cdot \log_{10}\frac{U_{St}}{U_{Sig}} \quad \text{dB}$$

U_{St} Measured value of the interference signal
U_{Sig} Determined value of the wanted signal

The worst condition is used in each case for the frequency and phase position of the interference. Since there are two manners in which the interference can affect the measuring circuit (common-mode or series-mode), two values in decibels are always required to completely specify the interference suppression.

The increasing energy density in modern plants means that it is advisable to suppress at least the induced series-mode interference at the point of occurrence (e.g. using commercially available contactors).



Series-mode interference induced by stray fields from adjacent equipment

Common-mode interference resulting from mains coupling of measuring circuit

Fig. 3/1 Generation of interference signals

Limit monitoring

The limit monitoring functions of the hybrid recorders output a binary signal when programmed limits are violated. Two limits (opto isolator outputs) can be programmed for each channel.

Technical explanations

Features

The VARIOGRAPH hybrid recorder has up to 12 channels for analog signals and/or 6 channels for digital signals (via serial interface and/or digital input/output). In addition, one of the channels 1 to 7 can be programmed to measure the mains frequency, and another to measure the terminal temperature. The minimum scanning cycle for all channels is 120 ms, and the maximum 3 s.

The recorder can be used as a multipoint or line recorder. Its fiber pen assembly records the measured values from up to 12 channels graphically and/or alphanumerically in 6 freely-selectable colors. The recorder can monitor the maximum and/or minimum values of measured variables in static or dynamic mode, and mark these on the chart by symbols with the channel No. and also with text or the time if required. Chart rolls are used, or also fanfold packs with the 7ND3521.

Further features of the VARIOGRAPH hybrid recorder:

- Permanent recording, or recording on event
- 2 different programs
- Menu-based programming with IR remote control unit
- Communication in 3 languages
- Display with selectable measured-value representation
- Measured-value buffer to cover the time required to replace the chart or pen assembly.

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Input range

The input range is the electrical range of the instrument amplifier (measuring limits). The ranges are adapted by programming or by using plug-in jumpers.

Example:
a): – 20 to + 20 mA for DC I as measured variable
b): – 10 to + 60 mV for TC as measured variable
c): – 20 to + 20 mA with function (for other physical variables)

The recording properties (measuring accuracy) of the instruments always refer to the input range.

Measuring range

Example:

a): For DC U/I as measured variable:
Measuring range = input range
e.g.: – 20 mA to + 20 mA

b): For direct connection of TC/RTD/R:
The measuring range is the range assigned to the input range with dimension (and linearization for TC and RTD).
e.g.: – 100 °C to + 900 °C for TC, type J

c): For any dimensions/other physical variables:
The measuring range is defined by programming a "Function".
e.g.: 4 mA to 20 mA corresponds to 0 to 250 t/h, thus:
measuring range = 0 to 250 t/h.

Recording and display range "Analog"

The recording and display range "Analog" defines the part of the measuring range which can be recorded and graphically displayed on the chart or as a bargraph.

This range is freely-programmable within the measuring range by input of "Left value" and "Right value".

Example:

a) 5 mA to 15 mA for DC I as measured variable,
measuring range – 20 mA to + 20 mA

b): 100 °C to 700 °C for TC, type J,
measuring range – 100 °C to + 900 °C

c): 50 t/h to 200 t/h via "Function",
measuring range 0 t/h to 250 t/h

Recording and display range "Digital"

The recording and display range "Digital" defines the range which can be displayed or printed as a digital value.

This range is identical to the measuring range. Thus the digital recording and display range may be larger than the analog recording and display range.

Example:

a): – 20 mA to + 20 mA for DC I as measured variable

b): – 100 °C to 900 °C for TC, type J

c): 0 t/h to 250 t/h via "Function"

Standards

The recorders comply with the following standards:

- Housing: DIN 43 700, DIN 43 831
- Error limits: IEC 484 (DIN 43 782)
- Degree of protection: IEC 529 or EN 60 529
- Climate: IEC 68-2-1/2
- Mechanical stress: IEC 68-2-6
- Electric protection: IEC 1010-1 (EN 61 010-1, VDE 0411 Part 1)
- Electromagnetic compatibility: the protection objectives of the EMC guideline 89/336/EEC with respect to interference suppression to EN 50 081-1 and noise immunity to EN 50 082-2 of 03/95 are complied with.
- Interference suppression: VDE 0875 Part 11 (CISPR 11)
- Noise immunity: IEC 1000-4-...

Chart drive

A program-controlled stepping motor is responsible for the time-synchronous chart drive.

In the VARIOGRAPH hybrid recorder, the drive controls a sprocket wheel, and the sprockets engage in the perforations of the chart paper and thus transport the latter.
The chart paper is tightened in the longitudinal direction by a take-up spool driven by the drive via a slip coupling.

Event marking system

The event marking system records an event (e.g. the switching on or off of a pump) by recording a binary variable (square-wave recording).

Chart paper

Chart paper for VARIOGRAPH hybrid recorders

The absorptive capacity of the ink paper is optimally matched to fiber pens. The paper has a very smooth surface so that the frictional resistance of the fiber pens is low.

Types of chart paper

Roll: low-price recording with greatest possible visible trace length.
Fanfold: (only for 7ND3521): fast access possible even to recordings made a long time earlier. Easy finding of specific positions by flipping through like in a book.

Chart paper graduations
(see Figs. 3/2 to 3/3 for examples)

- Range graduation

The recording width is divided linearly by longitudinal lines. Every fifth line is thicker than those in between.

Please contact us if you require chart paper with a non-linear range graduation or with printed text at regular intervals – e.g. range numbers, dimensions and measuring point names.

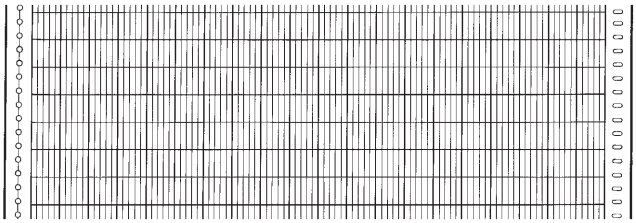


Fig. 3/2 Chart paper 230 mm wide, recording width 210 mm, 100 linear divisions (scale approx. 1:3)

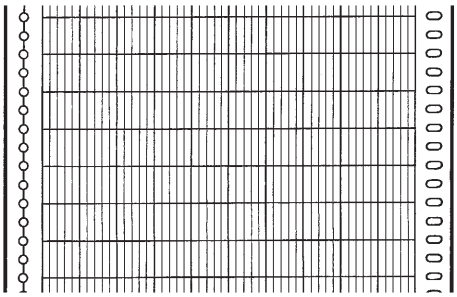


Fig. 3/3 Chart paper 120 mm wide, recording width 100 mm, 50 linear divisions (scale approx. 1:2)

Parameterization software

The SIMATIC PDM software permits you to use your PC for convenient dialog with the hybrid recorders.

Possible configurations

Various configurations are possible when operating the hybrid recorders via a PC:

Point-to-point operation

This is possible with the VARIOGRAPH by using the SIPROM R-VARIOGRAPH software and a null modem cable.

Bus operation

No standard solutions for bus operation exist for the VARIOGRAPH. Customer-specific solutions can be configured.

Ordering information

Ordering information

Standard models are listed in the Ordering data. The technical data contain additional data for further designs, e.g. applications and power supply.

If designs are required for which no information is included in the technical data, please inquire whether the desired model is technically possible.

When ordering, please state:
- Order No.
- Order code, if applicable
- Any plain text required (e.g. inscription of measuring point label, information on the measuring ranges).

Example for ordering:

Required recorder:

VARIOGRAPH 7ND3590 hybrid recorder
Format 288 x 144
For installation in panel with basic grid 72 x 72
Power supply DC 24 V

6 channels
6 freely-adjustable/programmable measuring ranges (according to signal modules fitted)
Channels 1 to 3: fitted with signal module DC U/I
Channels 4 to 6: fitted with signal module DC U/I

Electronic alarm output

Door with low-reflection glass

Measuring point label inscribed "Transformer station south" (channel 1), "Main substation 1" (channel 2), "Total current" (channel 3), "Total power output" (channel 4), "Speed turbine 1" (channel 5), "Imported power" (channel 6)

The Ordering data for this recorder must then be as follows (according to page 3/17):

Order No.:	7ND3590-2BB13-1DG9
Order code:	R1Y
Plain text:	Measuring point inscription:
	Channel 1: Transformer station south
	Channel 2: Main substation 1
	Channel 3: Total current
	Channel 4: Total power output
	Channel 5: Speed turbine 1
	Channel 6: Imported power

Note:

The following designations are used in this section for the signal modules/measured variables:

DC U/I:	DC voltage/direct current
AC U/I:	AC voltage/alternating current
RTD:	Resistance temperature detector (resistance thermometer)
TC:	Thermocouple
R:	Resistance

Universal hybrid recorder VARIOGRAPH

7ND3521 (144 x 144)
7ND3590 (288 x 144)
7ND3560 (288 x 288)

12 channels for analog measured variables

Common features

- 3, 6 or 12 channels for analog variables; up to 6 additional channels via interface (max. total of 12 channels, however), without pen offset
- Microprocessor-based
- Recording with fiber recording head, max. 6 colors
- Short scanning cycle with intermediate data memory
- Recording cycle independent of measured value, use as line recorder or multipoint recorder
- Storage of 2 user programs, protected by 4-digit code number
- Operating modes:
  - Displays (numeric and/or analog as bargraph)
  - Curves
  - Tables
- No data loss for curves with tables (mixed operation)
- Measured variables (measurement via plug-in signal modules):
  - Direct current, DC voltage
  - Temperature (connection to thermocouples and resistance thermometers)
  - Resistance (2-wire or 3-wire systems)
- Freely-programmable measuring ranges and alarms
- Zooming
- Zoning
- Programmable alarm identification and output for each channel with limit violation
- Logic operations on alarms
- Text and scale printouts
- Real-time calender clock, internal or external synchronization, e.g. by a master clock
- Date/time printout, channel identification and message text
- Operator prompting in German and English; French or Russian as option
- Operation and programming with infrared remote control unit and parameterization software (SIMATIC PDM)
- Coupling to interface-based automation systems via serial interfaces
- Recording paper: roll, or fanfold (only 7ND3521)
- Suitable for installation without interspacing
- Housing front: degree of protection IP 54

Fig. 3/4 VARIOGRAPH 7ND3521, format 144 x 144

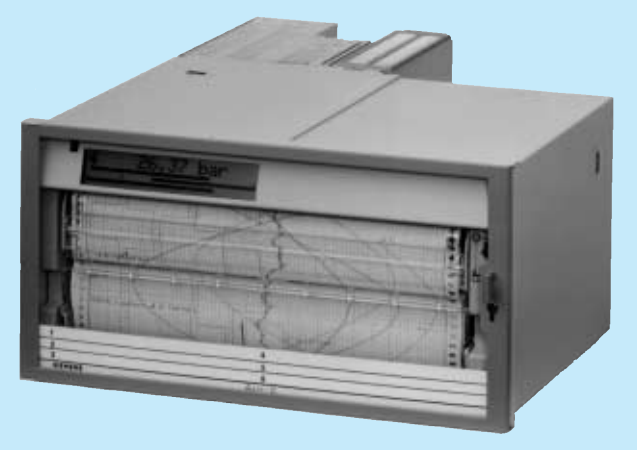


Fig. 3/5 VARIOGRAPH 7ND3590, format 288 x 144

Fig. 3/6 VARIOGRAPH 7ND3560, format 288 x 288

VARIOGRAPH 7ND3521, 7ND3590, 7ND3560

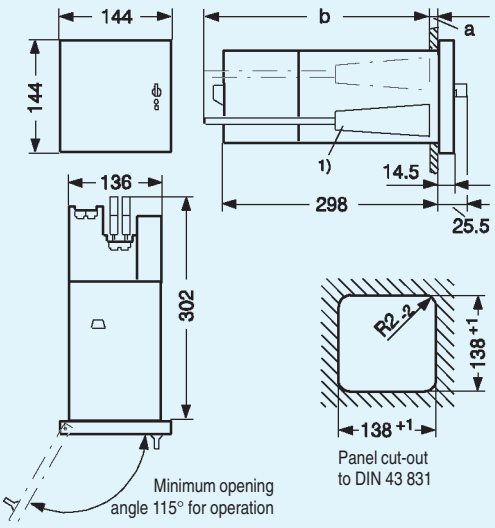
Universal hybrid recorders
144 x 144, 288 x 144 and 288 x 288

Technical data, basic device

Measurements	
Measuring procedure	Analog-to-digital conversion according to dual-slope procedure
Channels	
– Analog inputs	3, 6 or 12, connection via signal modules (channels 1 to 12)
– Digital inputs	6, connection via auxiliary modules "Serial interface" and/or "Digital input/output" (only for binary variables) (channels 7 to 12)
Scales	
– Printed in diagram	
Number	1 per channel, programmable
Generation	Automatic
Additional inscriptions	Channel number and dimension
– Mechanical on recorder (7ND3560 only)	Max. 4 divisions
Functions $y = f(x)$	6 freely-programmable assignments between the input variable *(x)* (signal range) and the output variable *(y)* (measuring range), e.g. linearization with max. 50 turning points each Dimension: 5 characters per dimension, freely-selectable per function, logic operations e.g. for control purposes
Measuring ranges	Adjustable/programmable for each range within the measuring limits of the signal modules
Programs	2 programs can be stored, selectable manually (internal/external) or via "Condition"
Available signal modules	
– 3-channel	7ND9400-8AA (DC U/I)
– 6-channel	7ND9400-8AF (DC U/I/TC/RTD/R) 7ND9400-8AJ (DC U/I/TC)
Available auxiliary modules	Serial interface 7ND9400-8BH Digital input/output 7ND9400-8BB
Error limits	Class 0.5, DIN 43 782
Basic device	0.3 % of recording width (100 mm)
Signal module 7ND9400-8AA	0.2 % with expansion factor of max. 4
Signal module 7ND9400-8AF	0.2 % with expansion factor of max. 5
Signal module 7ND9400-8AJ	0.2 % with expansion factor of max. 5 (spec. errors see pages 3/11 to 3/13)
Measured-value damping	Separate for each channel
Filter	1st order low-pass
Time constant	0 to 120 s, programmable in unit steps
Recording	
Recording range	"Left value" and "Right value" freely programmable
Data display	
– Graphic recording, curves	Line or multipoint recorder, freely-selectable color assignments, inscription with channel number and text or measured value
– Numeric recording, text	Data set with symbols, 1 device text, max. 16 characters, 12 channel texts, max. 16 characters each, 12 event texts, max. 53 characters each, freely-selectable color assignment
– Mixed recording	Alternate graphic and numeric recording
Recording procedure	Discontinuous with intermediate storage of data, pen offset compensated
Recording system	
– Pen assembly	Replaceable, with flexible fiber pen capillaries
– Colors	Violet, red, black, green, blue, brown
– Recording length	Approx. 1800 m
– Service life	Approx. 6 months
– Storage life	24 months in closed packing 1 month in device with climate to DIN IEC 654-1
– Character set	ASCII standard with upper-case and lower-case letters, Greek alphabet and special characters, selectable in 6 colors
– Length of text line	53 characters
– Character height	2.16 mm (standard)
Pen assembly drive	Program-controlled step motor
Carriage drive	Program-controlled step motor
Step length 7ND3521	0.125 mm = 0.125 %
7ND3560/90	0.125 mm = 0.06 %
Carriage speed	Max. 125 mm/s
Recording width 7ND3521	Max. 100 mm (selectable per channel)
7ND3560/90	Max. 210 mm (selectable per channel)
Chart drive	Program-controlled step motor, class 0.005 to DIN 43 782
Step length	0.06 mm to 0.6 mm programmable
Fast forward	1 mm/s to 30 mm/s
Chart speeds	0 (off) 1 – 1.25 – 2 – 2.5 – 5 mm/h 10 – 15 – 20 – 30 – 40 mm/h 50 – 60 – 100 – 120 – 150 mm/h 180 – 200 – 240 – 300 mm/h
7ND3521	600 – 1200 [1] mm/h
7ND3560/90	600 [1] – 1200 [1] mm/h
Printing interval for data table	∞ (off), 15 – 30 min 1 – 2 – 3 – 4 – 6 – 12 – 24 h
Chart paper	
Roll 7ND3521	31 m long, 120 mm wide
7ND3560/90	31 m long, 230 mm wide
Fanfold 7ND3521	16 m long, 120 mm wide
Visible chart length	
Roll 7ND3521/90	70 to 80 mm
7ND3560	200 mm
Fanfold 7ND3521	30 to 80 mm
Recording condition	Continuous recording or recording with "Condition", e.g. via alarms or their boolean operations
Display	
Display unit	Liquid crystal (DSTN)
Dot matrix	16 x 100
Characters	5 x 7 or 7 x 13 dots ASCII standard with upper-case and lower-case letters, Greek alphabet and special characters
Character height	6.85 mm or 12.85 mm
Data display	Number and dimension, 5 digits each
Bar display	0 to 100 %, resolution 1 %
Operation/programming	Via infrared remote control unit, menu-based, output of menu line on display of recorder, PC parameterization software
STATUS menu	Display and printout of device configuraiton, time, start table, code No., dialog address, device text
MODE menu	Chart speed, printing interval and display mode can be set in MODE A and MODE B, selectable manually (internal/external) or via "Condition"
PROGRAM menu	Parameters and recording conditions can be set in PROGRAM A and PROGRAM B, selectable manually (internal/external) or via "Condition"

[1] Not to be recommended for the output of highly oscillating signals with a large amplitude and/or the output of longer strings (such as texts and tables of data) over a longer period because of the possibility of data losses.

TEST menu	Calling of test functions
Operator prompting	German, English, French (Russian on request)
Limit monitoring	
Number of alarms	2 alarms per channel, programmable
Alarm output	Recording of a symbol and the channel number, optionally with text or time
– Static	On violation of upper or lower limit
– Dynamic (gradient)	On defined change in signal speed
Alarm output	Via auxiliary module "Digital input/ output" (page 3/13)
Limit hysteresis	0.01 to 5 % of measuring range, programmable in 9 steps
Logic operations on alarms	AND, OR, EXOR, negation
Data memory	Recording buffer for a chart length of approx. 55 mm to cover the time for replacing chart paper or pen assembly
Real-time calender clock	
Format	Year, month, day, hour, minute, second; 24-hour or 12-hour representation programmable
Program	Up to year 2048
Accuracy	Max. error 1 x 10^{-5} at 25 °C
Back-up on power failure	With 3-V lithium battery
External synchronization	Programmable by master clock via SYNC input or via power supply network
Control inputs	Passive, electrically isolated via opto isolator: START/STOP, CONTR. IN and SYNC. (Fig. 3/10)
Input resistance	≥ 5 kΩ
Low level	≤ 5 V, min. -3 V
High level	≥ 8 V, max. 30 V
General data	
Format 7ND3521	144 x 144 } DIN 43 700 and
7ND3560	288 x 288 } DIN 43 831
7ND3590	288 x 144 }
Mounting facilities	Sheet-steel panel, panel or desk upright panel with basic grid dimensions 72 x 72, cabinet or sheet-steel desk upright panel
Mounting	
Panel mounting	To DIN 43 834-A-340
Desk and cabinet mounting	To DIN 43 834-A-230
Mounting position	To DIN 16 257
Operation with roll	Vertical - 30 ° to + 15 °
Operation with fanfold	Vertical - 15 ° to + 15 °
Climatic ambient conditions	To IEC 68-2-1/2/ DIN EN 60 068-2-1/2
Temperature of use	0 to 50 °C (max. 75 % rel. humidity at 25 °C, no condensation), change in temperature max. 10 K/h
Storage temperature range	-25 to +70 °C (max. 75 % rel. humidity at 25 °C, no condensation), change in temperature max. 20 K/h
Mechanical ambient conditions	
Vibrations during operation	To DIN IEC 68-2-6 5 to 9 Hz; 3.5 mm deflection 9 to 200 Hz; 10 m/s^2 acceleration
Vibrations during storage and transport	To DIN IEC 68-2-6 5 to 9 Hz; 3.5 mm deflection 9 to 500 Hz; 10 m/s^2 acceleration
Drop test for packed unit	To DIN EN 60 068-2-32, height < 0.8 m
Shock test during operation	To DIN IEC 68 Part 2-27 15 g, 11 ms
Resistance to earthquakes during operation	Vibrations in the three axes X, Y, Z to DIN IEC 68 Part 2-6
Frequency range 5 ... 35 ... 5 Hz	2 g, 1 octave/min., max. ± 10 mm amplitude
Frequency range 10 ... 58 Hz, 58 ... 500 Hz	2 g, 5 cycles, 1 h
Protection class	I to IEC 348/DIN VDE 0411 Part 1
Degree of protection	EN 60 529 (IEC 529)
Terminals	IP 20
Housing, rear	IP 20
Housing door	IP 54
Test voltages	IEC 348/DIN VDE 0411 Part 1
Mains/housing	DC 2.1 kV
Control input/housing	AC 0.5 kV
Radio interference suppression	To DIN VDE 0871, limit class A
Power supply	
– AC/DC power pack 230 V	AC 50 to 60 Hz (- 5 to + 5 %) 110 to 240 V (- 15 to + 10 %), approx. 36 VA; DC 110 to 230 V (± 10 %), 18 W
– AC/DC power pack 24 V	AC 50 to 60 Hz (- 5 to + 5 %) 24 V (- 15 to + 10 %), approx. 36 VA; DC 24 V (18 to 33 V), approx. 18 W
Type of connections	Screw terminals
– Terminal range	
For solid conductors	0.13 to 2,5 mm^2
For stranded conductors	0.13 to 1.5 mm^2 (conductor sleeves)



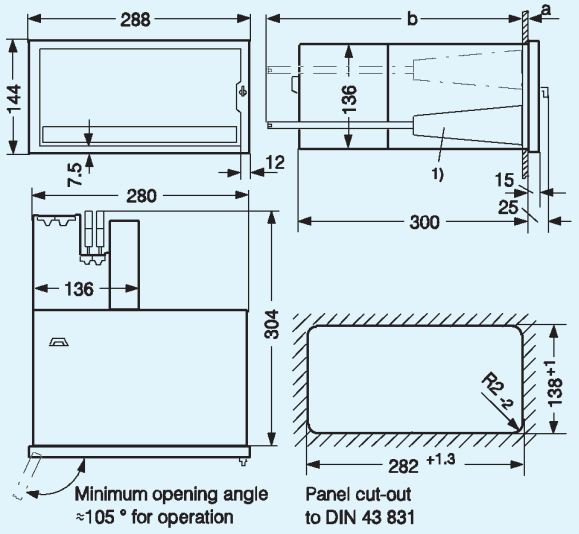
Distance between centers of 2 adjacent instruments or one above the other: ≥ 144 mm

Installation in	a	b
Sheet-steel panel or cabinet or sheet-steel desk upright panel	2 to 42	340
Panel with basic grid dimensions 72 x 72 or desk upright panel with basic grid dim. 72 x 72	39 to 81	305.5

Fig. 3/7 Universal hybrid recorder VARIOGRAPH 144 x 144, dimensions

[1]) The clamps can also be fitted at the top and bottom.

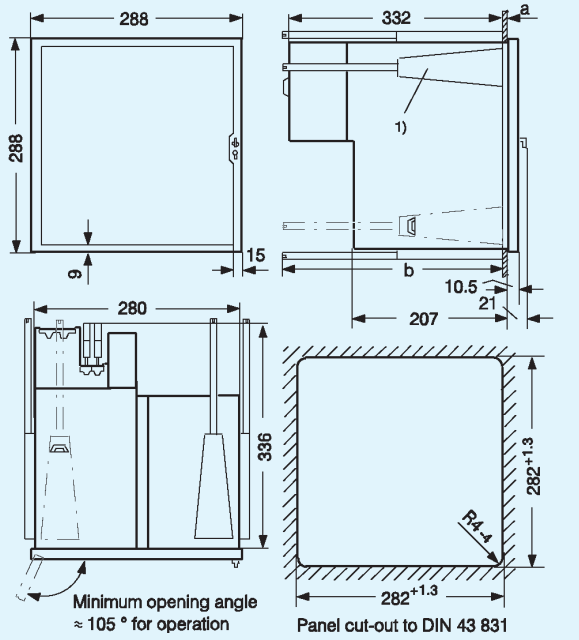
Universal hybrid recorders
144 x 144, 288 x 144 and 288 x 288



Distance between centers of 2 adjacent instruments: ≥ 288 mm
Distance between centers of 2 instruments one above the other: ≥ 144 mm

Installation in	a	b
Sheet-steel panel or cabinet or sheet-steel desk upright panel	2 to 42	340
Panel with basic grid dimensions 72 x 72 or desk upright panel with basic grid dim. 72 x 72	39 to 81	305.5

Fig. 3/8 Universal hybrid recorder VARIOGRAPH 288 x 144, dimensions



Distance between centers of 2 adjacent instruments or one above the other: ≥ 288 mm

Installation in	a	b
Sheet-steel panel or cabinet or sheet-steel desk upright panel	2 to 42	340
Panel with basic grid dimensions 72 x 72 or desk upright panel with basic grid dim. 72 x 72	39 to 81	305.5

Fig. 3/9 Universal hybrid recorder VARIOGRAPH 288 x 288, dimensions

Front door	7ND3521	Plastic; with matt border, with spring-loaded latch or with spring-loaded latch and lock
Front frame	7ND3560/90	Gray; front door with lock and glass pane
Weight	7ND3521	Approx. 4 kg
	7ND3560	Approx. 8.5 kg
	7ND3590	Approx. 6 kg

Electromagnetic compatibility

Emitted interference

The targets of the EMC guideline 89/336/EEC with respect to radio interference suppression to EN 50 081-1 and interference rejection to EN 50 082-2 of 03/95 are observed.

Radio interference	Measured according to VDE 0875 Part 11 (CISPR 11)
Power supply AC 110 to 240 V	Limit class B for shielded control cables

Interference rejection

Device-under-test	Influencing variable	Basic standard	Instrument	
			Test condition	Res [3]
Instrument	RF field AM	IEC 1000-4-3	10 V/m [2]	A
	RF field PM	IEC 1000-4-3	10 V/m	A
	Discharge	IEC 1000-4-2	6/8 kV	A
Process, measuring and control lines	RF conducted interference	IEC 1000-4-6	10 V	A
	Burst	IEC 1000-4-4	2 kV	A
AC/DC 24 V power supply	RF conducted interference	IEC 1000-4-6	10 V	A
	Burst	IEC 1000-4-4	2 kV	A
	Surge	IEC 1000-4-5	1/1 kV [4]	B
	Interruption	IEC SC77BWG3	20 ms/100 %	A
AC 110 to 240 V power supply	RF conducted interference	IEC 1000-4-6	10 V	A
	Burst	IEC 1000-4-4	2 kV	A
	Surge	IEC 1000-4-5	1/1 kV [5]	B
	Interruption	IEC SC77BWG3	20 ms/100 %	A
Earth connection	RF conducted interference	IEC 1000-4-6	10 V	A

[1] The clamps can be fitted on all sides.
[2] 3 V/m in the ranges 87 to 108, 174 to 230 and 470 to 790 MHz.
[3] A = additional error during effect of interference referred to span of signal modules when using shielded signal and control cables (screen connected to PE conductor at both ends):
- 7ND9400-8AA max. 0.2 %
- 7ND9400-8AF max. 0.2 %, but 0.5 % in range -10 to +60 mV and in the TC ranges
- 7ND9400-8AJ max. 0.2 %, but 0.5 % in the range -10 bis +60 mV and in the TC ranges

When using non-shielded cables, the above error may be up to 3 % in the sensitive signal and TC ranges (thermocouples), and 0.5 % in the other ranges.
B = interference possible during effect
[4] 1 kV symmetric, 1 kV asymmetric
[5] 1 kV symmetric, 2 kV asymmetric

Technical data, signal modules

Signal module DC U/I, 7ND9400-8AA

Number of channels	3, electrically isolated
Measured variables	Electrical variables (DC U/I)

Measuring range (adjustable)	Resolution Graphic min.	Numeric	Error [1] Absolute	Relative % of meas. value
DC voltage				
– 1 to + 1 V	100 µV	100 µV	0.75 mV	0.025
–10 to + 10 V	1 mV	1 mV	7.5 mV	0.025
Direct current				
– 10 to + 10 mA	1 µA	1 µA	7.5 µA	0.025
– 20 to + 20 mA	2 µA	2 µA	15 µA	0.025

Recording ranges	Programmable
Input resistance	
DC voltage	50 kΩ/V
Direct current	50 Ω (± 10 mA range) 25 Ω (± 20 mA range)
Potential	Max. permissible 24 V against protective earth conductor: only circuits with safe electrical isolation from the power supply are permissible
Measuring cycle with 1 or 2 signal modules in the VARIOGRAPH	
With 50-Hz mains frequency	120 ms
With 60-Hz mains frequency	100 ms
With DC power supply	120 or 100 ms, selectable [2]
Measuring duration with 1 or 2 signal modules in the VARIOGRAPH	
With 50-Hz mains frequency	20 ms
With 60-Hz mains frequency	16.6 ms
With DC power supply	20 or 16.6 ms, selectable [2]
Resolution and errors	According to table above
Additional temperature error	
Typical	30 ppm of span per K
Maximum	300 ppm of span per K
Continuous overload capacity	
Voltage input	Max. 30 V
Current input	Max. 80 mA
Surge overload capacity (5 s)	
Voltage input	Max. 30 V
Current input	Max. 100 mA
Analog-to-digital conversion	1 dual-slope converter/channel, resolution $14^1/_2$ bits
Series-mode rejection	≥ 60 dB for mains frequency
Common-mode rejecton	≥ 90 dB for mains frequency
Signal connection	Screw terminals
Terminal range	
For solid conductors	0.13 to 2.5 mm²
For stranded conductors	0.13 to 1.5 mm² (conductor sleeves)
Test voltages	IEC 348/DIN VDE 0411 Part 1
Signal input/housing	AC 500 V
Signal input/signal input	AC 500 V
Weight	Approx. 150 g

Signal module DC U/I/TC/RTD/R, 7ND9400-8AF

Number of channels	6, electrically isolated via relays
Measured variables	
• Electrical variables (DC U/I/R)	
Measuring ranges	Adjustable/programmable according to following table
Recording ranges	Programmable
Input resistance with:	
DC voltage measurements	10 MΩ
Direct current measurements	2.5 Ω
Current source for resistance measurements	Approx. 1 mA, built-in
Permissible line resistance with resistance measurements	
– 3-wire system	$R_L \leq R_E - R_M$, max. 100 Ω
– 2-wire system	$R_L \leq 0.5\ (R_E - R_M)$
	R_E 600 Ω full-scale value
	R_L Line resistance per conductor
	R_M Measuring resistance for full-scale value of recorder
Detection of line breakage with DC voltage measurements	Present
• Temperature via thermocouple (TC)	
Measuring ranges	Adjustable/programmable according to following table
Dimension	°C or K, selectable
Recording ranges	Programmable
Reference temperature	
Internal	Via measurement of terminal temperature, additional error ≤ 0.6 K
External	Via reference channel or – 50 to + 150 °C, programmable, 223 to 423 K, programmable
Potential	Max. permissible 24 V against PE conductor; only circuits with safe electrical isolation from the power supply are permissible
Input resistance	10 MΩ
Detection of line breakage	Present
• Temperature via resistance thermometer (RTD)	
Measuring ranges	Adjustable/programmable according to following table
Dimension	°C or K, selectable
Recording ranges	Programmable
Potential	Max. 24 V
Input resistance	10 MΩ
Current source	Approx. 1 mA, built-in
Permissible line resistance	
3-wire system	$R_L \leq R_E - R_M$, max. 100 Ω
2-wire system	$R_L \leq 0.5\ (R_E - R_M)$
	R_E 600 Ω full-scale value
	R_L Line resistance per conductor
	R_M Measuring resistance for full-scale value of recorder
Measuring cycle	3 s
Measuring duration	
With 50-Hz mains frequency	20 ms
With 60-Hz mains frequency	16.6 ms
With DC power supply	20 or 16.6 ms, selectable depending on frequency of adjacent AC network
Resolution and errors	According to following table
Additional temperature error	
Typical	15 ppm of span per K
Maximum	150 ppm of span per K
Continuous overload capacity	
Voltage input; current input	Max. 24 V; max. 225 mA
Surge overload capacity (5 s)	
Voltage input	Max. 24 V
Current input	Max. 300 mA
Analog-to-digital conversion	1 common dual-slope converter, resolution $13^1/_2$ bits

[1] Reference conditions: ambient temperature 23 °C ± 2 °C, relative humidity 55 % ± 10 %.
[2] Depending on frequency of adjacent AC network.

Universal hybrid recorders
144 x 144, 288 x 144 and 288 x 288

Series-mode rejection	≥ 60 dB for mains frequency
Common-mode rejection	≥ 90 dB for mains frequency
Signal connection	Screw terminals
Terminal range	
For solid conductors	0.13 to 2.5 mm²
For stranded conductors	0.13 to 1.5 mm² (conductor sleeves)
Test voltages	IEC 348/DIN VDE 0411 Part 1
Signal input/housing	AC 500 V
Signal input/signal input	DC 500 V
Weight	Approx. 440 g

Measuring range	Resolution Graphic min.	Resolution Numeric	Error [1] Absolute	Error [1] Relative % of meas. value
DC voltage				
- 10 to + 60 mV	6 µV	6 µV	20 µV	0.02
-100 to + 600 mV	60 µV	60 µV	130 µV	0.02
Direct current				
- 4 to + 20 mA	3 µA	3 µA	10 µA	0.03
- 40 to + 200 mA	30 µA	30 µA	100 µA	0.03
Resistance				
0 to 600 Ω	60 mΩ	0.1 Ω	0.2 Ω	0.04
Thermocouple to DIN IEC 584				
Type J Fe/Cu Ni				
-100 to + 1000 °C	0.2 °C	0.2 °C	0.3 °C	0.04
173 to 1273 K	0.2 K	0.2 K	0.3 K	0.04
Type K Ni Cr/Ni				
0 to 1200 °C	0.2 °C	0.2 °C	0.5 °C	0.04
273 to 1473 K	0.2 K	0.2 K	0.5 K	0.04
Type T Cu/Cu Ni				
0 to 400 °C	0.2 °C	0.2 °C	0.3 °C	0.04
273 to 673 K	0.2 K	0.2 K	0.3 K	0.03
Type S Pt 10% Rh/Pt				
0 to 1600 °C	0.6 °C	0.6 °C	1.5 °C	0.05
273 to 1873 K	0.6 K	0.6 K	1.5 K	0.05
Type R Pt 13% Rh/Pt				
0 to 1600 °C	0.6 °C	0.6 °C	1.5 °C	0.05
273 to 1873 K	0.6 K	0.6 K	1.5 K	0.05
Thermocouple to DIN 43 710				
Type L Fe-Cu Ni				
-100 to + 900 °C	0.2 °C	0.2 °C	0.3 °C	0.04
173 to 1173 K	0.2 K	0.2 K	0.3 K	0.04
Type U Cu-CuNi				
0 to 400 °C	0.2 °C	0.2 °C	0.3 °C	0.04
273 to 673 K	0.2 K	0.2 K	0.3 K	0.03
Resistance thermometer				
Pt 100 to DIN IEC 751				
-200 to +850 °C	0.2 °C	0.2 °C	0.4 °C	0.05
73 to 1123 K	0.2 K	0.2 K	0.4 K	0.04
Pt 200 according to manufacturer's data				
-200 to + 250 °C	0.1 °C	0.1 °C	0.2 °C	0.05
73 to 523 K	0.1 K	0.1 K	0.2 K	0.02
Ni 100 to DIN 43 760				
- 60 to + 240 °C	0.1 °C	0.1 °C	0.2 °C	0.05
213 to 513 K	0.1 K	0.1 K	0.2 K	0.03

Signal module DC U/I/TC, 7ND9400-8AJ

Number of channels	6, electrically isolated via semiconductor relays (reverse resistance > 2 GΩ at 100 V DC, breakdown voltage > 200 V DC)
Measured variables	
• Electrical variables (DC U/I)	
Measuring ranges	Adjustable/programmable according to following table
Recording ranges	Programmable
Input resistance with:	
DC voltage measurements	10 MΩ
Direct current measurements	2.5 Ω
• Temperature via thermocouple (TC)	
Measuring ranges	Adjustable/programmable according to following table
Dimension	°C or K, selectable
Recording ranges	Programmable
Reference temperature	
Internal	Via measurement of terminal temperature, additional error ≤ 0.6 K
External	Via reference channel or - 50 to + 150 °C, programmable, 223 to 423 K, programmable
Input resistance	10 MΩ
Detection of line breakage	40 to 500 kΩ, dependent on input signal Source resistance ≤ 2 kΩ
Potential	Max. permissible 24 V against PE conductor: only circuits with safe electrical isolation from the power supply are permissible
Measuring cycle	1.5 s with 1 to 12 channels
Measuring duration	
With 50-Hz mains frequency	20 ms
With 60-Hz mains frequency	16.6 ms
With DC power supply	20 or 16.6 ms, selectable depending on frequency of adjacent AC network
Resolution and errors	According to following table
Additional temperature error	
Typical	15 ppm of span per K
Maximum	150 ppm of span per K
Continuous overload capacity	
Voltage input, temperature	Max. 24 V
Current input	Max. 250 mA
Overload capacity	Max 5 % of full-scale value
Analog-to-digital conversion	1 common dual-slope converter, resolution $13^1/_2$ bits
Series-mode rejection	≥ 60 dB for mains frequency
Common-mode rejection	≥ 90 dB for mains frequency
Signal connection	Screw terminals
Terminal range	
For solid conductors	0.13 to 2.5 mm²
For stranded conductors	0.13 to 1.5 mm² (conductor sleeves)
Test voltages	According to DIN IEC 1010-1; the test specifications must be observed when retesting
Signal input/housing	DC 500 V
Weight	Approx. 200 g

[1] Reference conditions: ambient temperature 23 °C ± 2 °C, relative humidity 55 % ± 10 %.

Measuring range	Resolution Graphic min.	Numeric	Error [1] Absolute	Relative % of meas. value
DC voltage				
– 10 to + 60 mV	6 µV	6 µV	20 µV	0.02
– 0.1 to + 1 V	100 µV	100 µV	250 µV	0.02
Direct current				
– 4 to + 20 mA	3 µA	3 µA	10 µA	0.03
Thermocouple to DIN IEC 584				
Type J Fe/Cu Ni				
–100 to +1000 °C	0.2 °C	0.2 °C	0.4 °C	0.04
173 to 1273 K	0.2 K	0.2 K	0.4 K	0.04
Type K Ni Cr/Ni				
0 to 1200 °C	0.2 °C	0.2 °C	0.5 °C	0.04
273 to 1473 K	0.2 K	0.2 K	0.5 K	0.04
Type T Cu/Cu Ni				
0 to 400 °C	0.2 °C	0.2 °C	0.5 °C	–0.04
273 to 673 K	0.2 K	0.2 K	0.5 K	–0.03
Type S Pt 10% Rh/Pt				
0 to 1600 °C	0.6 °C	0.6 °C	3 °C	–0.05
273 to 1873 K	0.6 K	0.6 K	3 K	–0.05
Type R Pt 13% Rh/Pt				
0 to 1600 °C	0.6 °C	0.6 °C	3 °C	–0.05
273 to 1873 K	0.6 K	0.6 K	3 K	–0.05
Thermocouple to DIN 43 710				
Type L Fe-Cu Ni				
–100 to + 900 °C	0.2 °C	0.2 °C	0.4 °C	0.04
173 to 1173 K	0.2 K	0.2 K	0.4 K	0.04
Type U Cu–CuNi				
0 to 400 °C	0.2 °C	0.2 °C	0.5 °C	–0.04
273 to 673 K	0.2 K	0.2 K	0.5 K	–0.03

Auxiliary module: "Serial interface" 7ND9400-8BH

Interfaces	20-mA current loop (TTY), RS-232, RS-485, electrically isolated from basic electronics
Procedures	Xon/Xoff ETX-ACK/NAK
Transmission rates	110/150/300/600/1200/2400/4800/9600/19200 bits/s
Data formats	Decimal ASCII Real Hex ASCII Real BCD ASCII
Operating modes	Manual/remote operation, Listen Only, Talk Only
External power supply	DC 18 to 30 V
Current consumption	Max. 125 mA
Connection	Subminiature socket, 25-contact
Weight	Approx. 90 g

Auxiliary module: "Digital input/output" 7ND9400-8BB

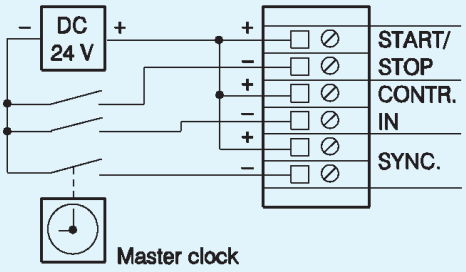
Inputs	6 passive inputs, electrically isolated from basic electronics via opto isolator
Input resistance	≥ 5 kΩ
Low level	≤ 5 V, min. – 3 V
High level	≥ 8 V, max. 30 V
Polarity reversal protection	Up to 40 V
Outputs	8 outputs, electrically isolated from basic electronics via opto isolator
Technology	Semiconductor drivers, short-circuit-proof and overload-proof
Output current	Max. 150 mA
Low level	≤ 0.3 V
High level	≥ U_V – 2 V U_V : power supply
External power supply	DC 18 to 30 V
Current consumption	
Typical	60 mA (all outputs inactive)
Maximum	1260 mA (all outputs active)
Test voltages	IEC 348/DIN VDE 0411 Part 1
Input/output/housing	AC 500 V
Connection	Subminiature plug, 25-pin
Weight	Approx. 80 g

Infrared remote control unit 7ND9190-8AA

Transmission mode	Pulse-modulated infrared signal (biphase coding)
Range	Approx. 5 m, depending on state of battery
Radiation angle	Approx. 30°
Number of keys	30
Functions	See Fig. 3/17
Temperature of use	0 to 50 °C
Storage temperature range	– 25 to + 70 °C
Permissible relative humidity	Max. 75 %, no condensation
Climatic class	2 to VDI/VDE 3540, but KWF DIN 40 040
Degree of protection	IP 40 EN 60 529
Battery	4 alkaline batteries Micro type 4003, IEC LR 6
– Voltage	4 x 1.5 V
– Service life	
With low usage	Approx. 1 year
With high usage	Approx. 100 hours
Dimensions (W x H x D)	57 mm x 23 mm x 135 mm
Weight	Approx. 110 g (including battery)

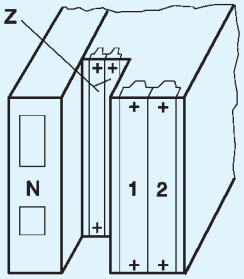
[1] Reference conditions: ambient temperature 23 °C ± 2 °C, relative humidity 55 % ± 10 %.
$F = F_{abs} + F_{rel} \cdot |MW|$ (with DC voltage and direct current)
$F = F_{abs}$ [°C] + $F_{rel} \cdot |MW$ [°C]$|$ or $F = F_{abs}$ [K] + $F_{rel} \cdot |MW$ [K] $\cdot$ 273 K$|$ (with thermocouples)

Universal hybrid recorders
144 x 144, 288 x 144 and 288 x 288



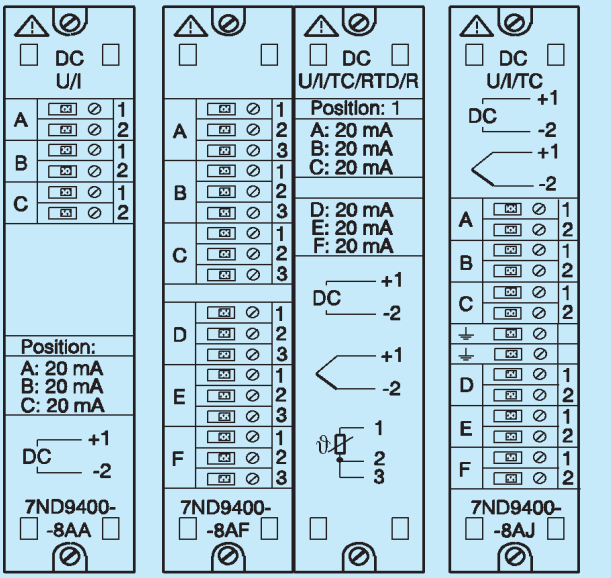
START/STOP Beginning/end of measurement
CONTR. IN Mode/program switchover/recording conditions
SYNC. External synchronization of calender clock by a master clock or by a VARIOGRAPH as the control unit

Fig. 3/10 VARIOGRAPH 7ND35.., connection of control signal lines



N Power pack
Z Auxiliary module slots
1 Signal module slot 1 (position 1)
2 Signal module slot 2 (position 2 with two 3-channel signal modules or two 6-channel signal modules 7ND9400-8AJ)

Fig. 3/11 VARIOGRAPH 7ND.., rear view



DC U/I
Signal module, 3-channel

Signal connections
Signal module in slot 1 (Fig. 3/11), position 1, A to C: channels 1 to 3
Signal module in slot 2 (Fig. 3/11), position 2, A to C: channels 4 to 6

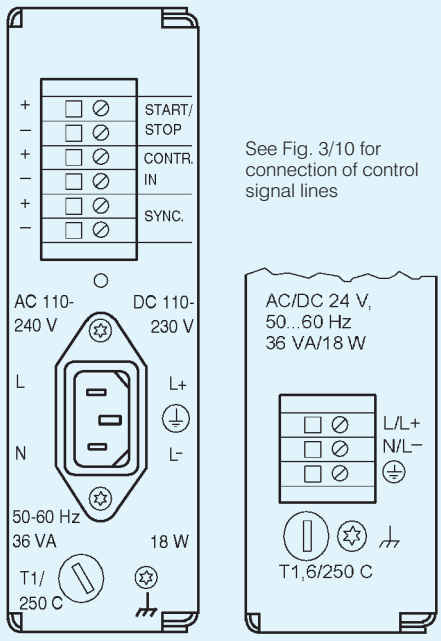
DC U/I/TC/RTD/R
Signal module, 6-channel

Signal connections
Signal modules in slots 1 and 2 (Fig. 3/11), position 1, A to F: channels 1 to 6

DC U/I/TC
Signal module, 6-channel

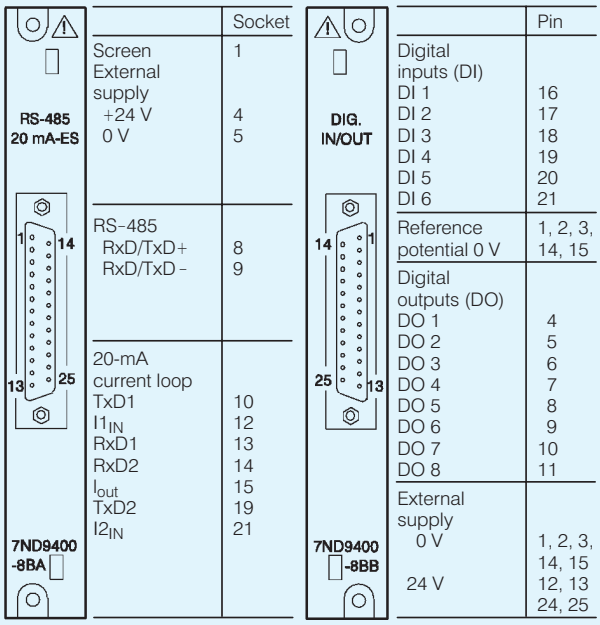
Signal connections
Signal modules in slot 1 or 2 (Fig. 3/11), position 1, A to F: channels 1 to 6, position 2, A to F: channels 7 to 12

Fig. 3/13 VARIOGRAPH 7ND35.., connection diagrams for the signal modules (setting on delivery: all channels in basic setting 20 mA)



UC power pack 230 V **UC power pack 24 V**

Fig. 3/12 VARIOGRAPH 7ND35.., connection for power pack



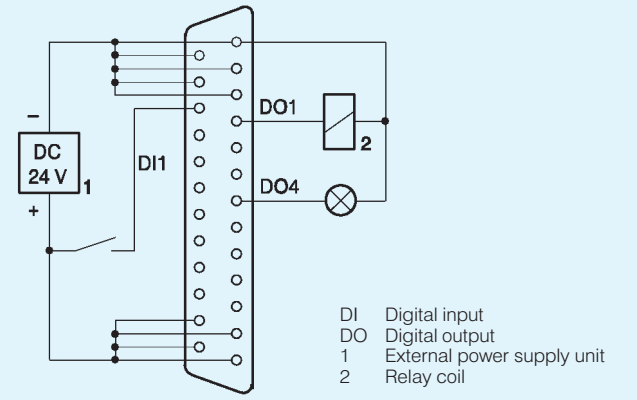
	Socket
Screen	1
External supply	
+24 V	4
0 V	5
RS-485	
RxD/TxD+	8
RxD/TxD-	9
20-mA current loop	
TxD1	10
$I1_{IN}$	12
RxD1	13
RxD2	14
I_{out}	15
TxD2	19
$I2_{IN}$	21

	Pin
Digital inputs (DI)	
DI 1	16
DI 2	17
DI 3	18
DI 4	19
DI 5	20
DI 6	21
Reference potential 0 V	1, 2, 3, 14, 15
Digital outputs (DO)	
DO 1	4
DO 2	5
DO 3	6
DO 4	7
DO 5	8
DO 6	9
DO 7	10
DO 8	11
External supply	
0 V	1, 2, 3, 14, 15
24 V	12, 13 24, 25

Serial interface with subminiature socket

Digital input/output with subminiature plug

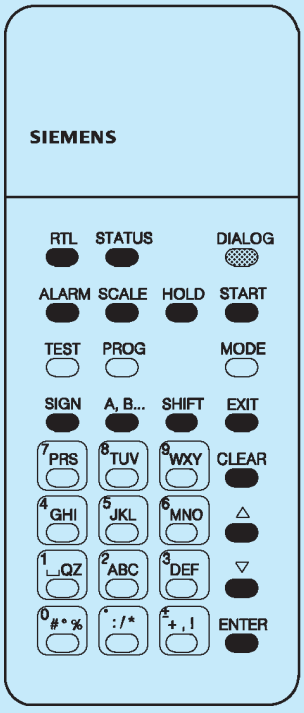
Fig. 3/14 VARIOGRAPH 7ND35.., connection for the auxiliary modules



DI Digital input
DO Digital output
1 External power supply unit
2 Relay coil

Fig. 3/15 Digital input/0utput, connection example

Fig. 3/16 Infrared remote control unit 7ND9190-8AA



RTL	Return to local (manual operation)
STATUS	Call device status (ON/OFF)
DIALOG	Start dialog
ALARM	Display alarm 1 and/or alarm 2 of current channel
SCALE	Display left value or right value of current channel
HOLD	Fixed/cyclic data display
START	Measure (ON/OFF)
TEST	Test functions (ON/OFF)
PROG	Program input (ON/OFF)
MODE	Set operating mode (ON/OFF)
SIGN	Input of special characters using coding table (ON/OFF)
A, B ...	Text input via additional assignments of decimal keypad (ON/OFF)
SHIFT	Select upper-case/lower-case letters (non-numeric input)
EXIT	Leave operator prompting menus
CLEAR	Clear input (numeric input)
	Clear character (non-numeric input)
△	Increment key (menu)
	Shift cursor to right (non-numeric input)
▽	Decrement key (menu)
	Shift cursor to left (non-numeric input)
Decimal keypad	For numeric and non-numeric inputs (letters and special characters)
ENTER	Release numeric input

Fig. 3/17 Infrared remote control unit 7ND9190-8AA

Universal hybrid recorder 144 x 144

Ordering data

Ordering data					Order No.	Order code	Price
VARIOGRAPH Universal hybrid recorder, front dimensions 144 x 144 With recording unit for rolls or fanfold paper					7ND3521- ■■■■■ - ■■■■ ■■■		
Power supply	AC 50 to 60 Hz 110 to 240 V, DC 110 to 230 V AC 50 to 60 Hz 24 V, DC 24 V				1 2		
Signal modules (analog inputs)	Measured variables/limits	Channels 1 to 3	Channels 4 to 6	Meas. cycle			
Without sig. mod.	–	Not fitted 2)		–	AA		
Signal module, 3-channel DC U/I 1)	DC voltage / ± 10 V Direct current / ± 20 mA	Fitted	Not fitted 2)	120 ms	BA		
		Fitted	Fitted		BB		
Signal module, 6-channel DC U/I/TC/RTD/R 1)	DC voltage /–100 mV, +600 mV Direct current/–40 mA, +200 mA Resistance / 0 Ω, 600 Ω Temperature via thermocouple or resistance thermometer	Fitted		3 s	GA		
Signal module, 6-channel DC U/I/TC 1)		1 to 6	7 to 12				
	DC voltage /–10 mV, +1 V Direct current/– 4 mA, + 20 mA	Fitted	Not fitted	1.5 s	HA		
	Temperature via thermocouple	Fitted	Fitted		HH		
Auxiliary modules (digital inputs and outputs)	Without auxiliary modules 2)				11		
	With serial interface				12		
	With digital input/output				13		
	With serial interface and digital input/output				14		
Housing door in protection IP 54 3)	Without lock	Standard door			1N		
		Low-reflection door			1P		
	With lock	Standard door			1R		
		Low-reflection door			1S		
Installation	In sheet-steel panel, cabinet or sheet-steel desk upright panel, with 2 clamps C72165-A405-B177				A		
	In panel or desk upright panel with basic grid dimension 72 x 72, with one set of mounting parts C79453-A3011-D100				G		
Measuring-point label	Unlabelled				1		
	Labelled (max. 29 digits per channel): Specify desired inscription in plain text:				9	R1Y	

Further designs on request.
Accessories, spare parts, consumable material and conversion parts on page 3/19.

Available ex stock

Note:
Operation always requires a remote control unit 7ND9190-8AA.

1) Basic setting on delivery: all channels 20 mA.
2) Can be upgraded (see page 3/19).
3) Also available in IP 51 for KWU control panels.

Scope of delivery:
VARIOGRAPH 7ND3521, fitted as ordered
1 roll of chart paper
1 accessories bag (pen assembly, lithium battery and 2 fuses)
2 clamps or 1 set of mounting parts
With auxiliary modules: 1 or 2 connectors
Instructions "Parameterization – a concise overview"

When using several VARIOGRAPH recorders it is sometimes only necessary to have one Manual. This is therefore not included in the delivery and must be ordered separately.

Universal hybrid recorder 288 x 144

Ordering data

					Order No.	Order code	Price
VARIOGRAPH Universal hybrid recorder, front dimensions 288 x 144 With recording unit for rolls					7ND3590-■■■■■-■■■■ ■■■		
Power supply	AC 50 to 60 Hz 110 to 240 V, DC 110 to 230 V				1		
	AC 50 to 60 Hz 24 V, DC 24 V				2		
Signal modules (analog inputs)	Measured variables/limits	Channels 1 to 3	Channels 4 to 6	Meas. cycle			
Without sig. mod.	–	Not fitted 2)		–	AA		
Signal module, 3-channel DC U/I	DC voltage / ± 10 V Direct current / ± 20 mA 1)	Fitted	Not fitted 2)	120 ms	BA		
		Fitted	Fitted		BB		
Signal module, 6-channel DC U/I/TC/RTD/R 1)	DC voltage /–100 mV, +600 mV Direct current/–40 mA, +200 mA Resistance / 0 Ω, 600 Ω Temperature via thermocouple or resistance thermometer	Fitted		3 s	GA		
Signal module, 6-channel DC U/I/TC 1)	DC voltage /–10 mV, +1 V Direct current/– 4 mA, + 20 mA Temperature via thermocouple	1 bis 6	7 bis 12	1.5 s			
		Fitted	Not fitted		HA		
		Fitted	Fitted		HH		
Auxiliary modules (digital inputs and outputs)	Without auxiliary modules 2)				11		
	With serial interface				12		
	With digital input/output				13		
	With serial interface and digital input/output				14		
Housing door	With lock	Standard door			1C		
		Door with low-reflection glass			1D		
Installation	In sheet-steel panel, cabinet or sheet-steel desk upright panel, with 2 clamps C72165-A405-B177				A		
	In panel or desk upright panel with basic grid dimension 72 x 72, with one set of mounting parts C79453-A3011-D100				G		
Measuring-point label	Unlabelled				1		
	Labelled (max. 29 digits per channel) Specify desired inscription in plain text:				9	R1Y	

Further designs on request.
Accessories, spare parts, consumable material and conversion parts on page 3/19.

Note:
Operation always requires a remote control unit 7ND9190-8AA.

1) Basic setting on delivery: all channels 20 mA.
2) Can be upgraded (see page 3/19).

Scope of delivery:
VARIOGRAPH 7ND3590, fitted as ordered
1 roll of chart paper
1 accessories bag (pen assembly, lithium battery and 2 fuses)
2 clamps or 1 set of mounting parts
With auxiliary modules: 1 or 2 connectors
Instructions "Parameterization – a concise overview"

When using several VARIOGRAPH recorders it is sometimes only necessary to have one Manual. This is therefore not included in the delivery and must be ordered separately.

Universal hybrid recorder 288 x 288

Ordering data

Description					Order No.	Order code	Price
VARIOGRAPH Universal hybrid recorder, front dimensions 288 x 288 With recording unit for rolls					7ND3560- ■ ■ ■ ■ ■ - ■ ■ ■ ■ ■ ■ ■		
Power supply	AC 50 to 60 Hz 110 to 240 V, DC 110 to 230 V				1		
	AC 50 to 60 Hz 24 V, DC 24 V				2		

Signal modules (analog inputs)	Measured variables/limits	Channels 1 to 3	Channels 4 to 6	Meas. cycle	Order No.
Without sig. mod.	–	Not fitted 2)		–	AA
Signal module, 3-channel DC U/I	DC voltage / ± 10 V Direct current / ± 20 mA 1)	Fitted	Not fitted 2)	120 ms	BA
		Fitted	Fitted	120 ms	BB
Signal module, 6-channel DC U/I/TC/RTD/R 1)	DC voltage /–100 mV, +600 mV Direct current/–40 mA, +200 mA Resistance / 0 Ω, 600 Ω Temperature via thermocouple or resistance thermometer	Fitted		3 s	GA
Signal module, 6-channel DC U/I/TC 1)	DC voltage /–10 mV, +1 V	1 bis 6	7 bis 12	1.5 s	
	Direct current/– 4 mA, + 20 mA	Fitted	Not fitted		HA
	Temperature via thermocouple	Fitted	Fitted		HH

Description			Order No.	Order code
Scale (mechanical on device)	Scale graduation (max. 4 graduations possible)			
	0 to 100 % (for all channels)		1	
	As specified in plain text		2	-Z Y01
Auxiliary modules (digital inputs and outputs)	Without auxiliary modules 2)		1	
	With serial interface		2	
	With digital input/output		3	
	With serial interface and digital input/output		4	
Housing door	With lock	Standard door	1C	
		Door with low-reflection glass	1D	
Installation	In sheet-steel panel, cabinet or sheet-steel desk upright panel, with 2 clamps C72165-A405-B177		A	
	In panel or desk upright panel with basic grid dimension 72 x 72, with one set of mounting parts C79453-A3011-D100		G	
Measuring-point label	Unlabelled		1	
	Labelled (max. 29 digits per channel)		9	R1Y
	Specify desired inscription in plain text:		......	

Further designs on request (e.g. front dimensions 360 x 288 or black front frame)
Accessories, spare parts, consumable material and conversion parts on page 3/19.

Note:
Operation always requires a remote control unit 7ND9190-8AA.

1) Basic setting on delivery: all channels 20 mA.
2) Can be upgraded (see page 3/19).

Scope of delivery:
VARIOGRAPH 7ND3560, fitted as ordered
1 roll of chart paper
1 accessories bag (pen assembly, lithium battery and 2 fuses)
4 clamps or 1 set of mounting parts
With auxiliary modules: 1 or 2 connectors
Instructions "Parameterization – a concise overview"

When using several VARIOGRAPH recorders it is sometimes only necessary to have one Manual. This is therefore not included in the delivery and must be ordered separately.

Ordering data	Order No.	Price
Accessories		
Infrared remote control unit [4] with four 1.5-V alkaline batteries	**7ND9190-8AA**	
Manual [4] [7] including brief instructions and spare parts list		
– For 7ND3521 and 7ND3590		
German	**C79000-G7300-C79**	
English	**C79000-G7376-C79**	
French	**C79000-G7377-C79**	
– For 7ND3560		
German	**C79000-G7300-C185**	
English	**C79000-G7376-C185**	
French	**C79000-G7377-C185**	
Instructions "Parameterization – a concise overview"		
German	**C79000-M7300-C94**	
English	**C79000-M7376-C94**	
French	**C79000-M7377-C94**	
Transport housing for VARIOGRAPH 7ND3521		
– For AC 230 V version	**7ND9500-8AB1**	
– For DC 24 V version	**7ND9500-8AB2**	
for VARIOGRAPH 7ND3590		
– For AC 230 V version	**7ND9500-8AC1**	
– For DC 24 V version	**7ND9500-8AC2**	
SIMATIC PDM software from V5.2 onwards (serial interface required) for parameterization of VARIOGRAPH 7ND3521, 7ND3590, 7ND3560 hybrid recorders; with documentation (as help file)	**See catalog FI 01**	
Consumable material		
Pen assembly (6 colors), violet, red, black, green, blue and brown	**7ND9001-8FB**	
Chart paper 120 mm wide, roll, for 7ND3521 (approx. 31 m long, recording width 100 mm, 50 linear graduations, weight approx. 0.15 kg)		
Hours imprint	**C72452-A94-B208**	
For 10 mm/h	**C72452-A94-B209**	
20 mm/h	**C72452-A94-B210**	
60 mm/h	**C72452-A94-B211**	
120 mm/h	**C72452-A94-B212**	
Without		
Price per roll when ordering		
20		
60		
100		
Chart paper 230 mm wide, roll, for 7ND3560 or 7ND3590 (approx. 31 m long, recording width 210 mm, 100 linear graduations, without hours imprint, weight approx. 0.35 kg)	**C72452-A98-B172**	
Price per roll when ordering		
20		
60		
100		
Chart papier 120 mm wide, fanfold, for 7ND3521 (approx. 16 m long, recording width 100 mm, 50 linear graduations, weight approx. 0.15 kg)		
Hours imprint	**C72452-A94-B262**	
For 10 mm/h	**C72452-A94-B263**	
20 mm/h	**C72452-A94-B264**	
60 mm/h	**C72452-A94-B265**	
120 mm/h	**C72452-A94-B266**	
Without		
Price per pack when ordering		
20		
60		
100		

	Order No.	Price
Replacement parts		
Take-up spool for		
7ND3521	**C72301-A20-B110**	
7ND3560	**C79453-A3068-B9**	
7ND3590	**C79301-A3000-B4**	
Recording unit for fanfold paper für 7ND3521	**C72301-A20-A6**	
Recording unit for rolls für 7ND3590	**C79301-A3000-A2**	
Recording unit for rolls or fanfold paper for 7ND3521	**C72301-A20-A7**	
Lithium battery, 3 V	**W79084-L1004-B1**	
Conversion parts		
Signal module, 3-channel (2 modules possible per recorder). The defined values are measuring limits		
DC U/I (DC voltage ± 10 V, direct current ± 20 mA) [1] [6]	**7ND9400-8AA**	
Signal module, 6-channel DC U/I/TC/RTD/R (1 module possible per recorder) DC voltage –100 mV, + 600 mV Direct current – 40 mA, + 200 mA Resistance 0 Ω, 600 Ω Temperature via thermocouple or resistance thermometer [1]	**7ND9400-8AF**	
DC U/I/TC (2 modules possible per recorder, cannot be combined with 3-channel modules) DC voltage –10 mV, +1 V Direct current – 4 mA, + 20 mA Temperature via thermocouple [1]	**7ND9400-8AJ** [3]	
Serial interface 20-mA current loop, RS-232, RS-485 with enclosed zero modem cable	**7ND9400-8BH** [3] [5]	
Digital input/output with 6 inputs and 8 outputs	**7ND9400-8BB**	
Measuring-point label without inscription		
For 7ND3521	**C79165-A3029-B10**	
For 7ND3560	**C79453-A3066-B119**	
For 7ND3590	**C79165-A3029-B82**	
Measuring-point label with inscription		
For 7ND3521	**C79165-A3029-B10-Z**	
For 7ND3560	**C79453-A3066-B119-Z**	
For 7ND3590	**C79165-A3029-B82-Z**	
Order code Specify in plain text: **Desired text: . . .** [2]	**Y01**	

Available ex stock

[1] Basic setting on delivery: all channels 20 mA.
[2] Max. 29 characters per channel.
[3] Can be used with firmware version 08 of recorder and later (can be called in STATUS menu). Firmware upgrading not possible.
[4] When using several VARIOGRAPH hybrid recorders it is sometimes only necessary to have one remote control unit and one Manual. These are therefore not included in the delivery and must be ordered separately.
[5] For use in recorders with firmware ≥ 07 to ≤ 08 on request.
[6] See chapter 4 for further 3-channel signal modules.
[7] Also available by downloading from the Internet (see page 5/10 bottom).