

ISOMETER[®] iso685-...

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)



ISOMETER® iso685-...

BENDER



ISOMETER® iso685-D

Device features

- ISOMETER[®] for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of *AMP^{Plus}* and other profilespecific measurement methods
- Two separately adjustable response value ranges of 1 k $\Omega...10~M\Omega$
- High-resolution graphical LC display
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Current or voltage output 0(4)...20 mA, 0...400 µA, 0...10 V, 2...10 V (galvanically separated), which is analogous to the measured insulation value of the system
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver/Option: COMTRAXX[®] gateway)
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- RS-485/BS (Bender sensor bus) for data exchange with other Bender devices
- BCOM, Modbus TCP/RTU and web server
- Voltage expandable via coupling devices

Product description

The ISOMETER[®] is an insulation monitoring devices in accordance with IEC 61557-8 for IT systems. The devices are universally applicable in AC, 3(N)AC, AC/DC and DC systems. AC systems may include extensive DC-supplied loads (such as rectifiers, inverters, variable-speed drives).

Application

- AC, DC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components, such as rectifiers, converters, regulated drives
- · Heaters with phase control
- Systems including switch-mode power supplies
- IT systems with high leakage capacitances
- UPS systems, battery systems

Function

The insulation monitoring device continuously monitors the entire insulation resistance of an IT system during operation and triggers an alarm when the value falls below a preset response value. To obtain a measurement the device has to be connected between the IT system (unearthed system) and the protective earth conductor (PE). A measuring current in the μ A range is superimposed onto the system which is recorded and evaluated by a microprocessor-controlled measuring circuit. The measuring time is dependent on the selected measurement profiles, the system leakage capacitance, the insulation resistance and possible system-related disturbances.

The response values and other parameters are set using a commissioning wizard as well as via different setup menus using the device buttons and a high-resolution graphical LC display. The selected settings are stored in a permanent fail-safe memory. Different languages can be selected for the setup menus as well as the messages indicated on the display. The device utilises a clock for storing fault messages and events in a history memory with time and date stamp. The settings can be password protected to prevent unauthorised changes.

To ensure proper functioning of connection monitoring, the device requires the setting of the system type 3AC, AC or DC and the required use of the appropriate terminals L1/+, L2, L3/-.

To extend the nominal voltage range, different coupling devices are available as accessories which can be selected from a menu where the required adjustments can also be made.

The insulation monitoring device iso685–x is able to measure the insulation resistance reliably and precisely in all common IT systems (unearthed systems). Due to various applications, system types, operating conditions, application of variable-speed drives, high system leakage capacitances etc., the measurement technique must be able to meet varying requirements in order to ensure an optimised response time and relative uncertainty. Therefore different measuring profiles can be selected with which the device can optimally adjusted.

If the preset response value falls below the value of Alarm 1 and/or Alarm 2, the associated alarm relays switch, the LEDs ALARM 1 or ALARM 2 light and the measured value is shown on the LC display (in case of insulation faults in DC systems, a trend graph for the faulty conductor L+/L- is displayed). If the fault memory is activated, the fault message will be stored. Pressing the RESET button resets the insulation fault message, provided that the current insulation resistance displayed at the time of resetting is at least 25 % above the actual response value.

As additional Information, the quality of the measuring signal and the time required to update the measured value are shown on the display. A poor signal quality (1-2 bars) may be an indication that the wrong measurement profile has been selected.

The ISOMETER® is able to synchronise itself with other ISOMETER®s. This makes it possible to monitor capacitive coupled IT systems without interfering with each other.



Interfaces

- Communication protocol Modbus TCP
- BCOM for Bender device communication via Ethernet
- BS bus for communication of Bender devices (RS-485)
- Integrated web server for reading out measured values and for parameter setting.

Device variants

iso685-D

This device variant features a high-resolution graphic LC display and operating controls for direct operation of the device functions. It **cannot** be combined with an FP200.

iso685-S

This device variant features **neither a display nor operating controls**. It can only be used in combination with the FP200 and it is operated via this front panel.

Option "W"

The ISOMETER®s with and without integrated display are available with option "W" for extreme climatic and mechanical conditions (ISOMETER® iso685W-D and iso685W-S).

Operating elements



Measurement method

AMPPlus The iso685 series uses the patented **AMP**^{Plus} measurement method. This measurement method allows concise monitoring of modern power supply systems, also in case of extensive, directly connected DC components and high system leakage capacitances.

Standards

The ISOMETER[®] has been developed in compliance with the following standards:

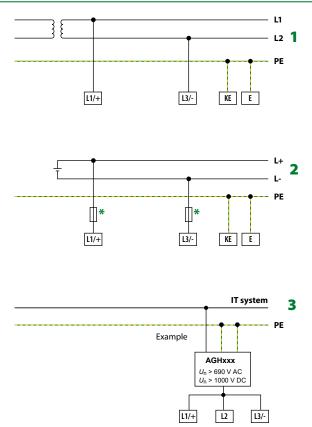
- DIN EN 61557-8 (VDE 0413-8):2015-12
- IEC 61557-8:2014-12
- IEC 61557-8:2014/COR1:2016
- DIN EN 61557-8 Ber 1 (VDE 0413-8 Ber 1):2016-12

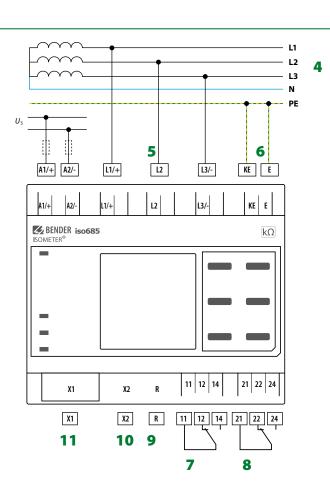
Certifications



- 1 ON The LED "ON" lights when the device is turned on.
- 2 SERVICE The LED "SERVICE" lights when there is either a device fault or a connection fault, or when the device is in maintenance mode.
- 3 ALARM 1 The LED "ALARM 1" lights when the insulation resistance of the IT system falls below the set response value *R*_{an1}.
- 4 ALARM 2 The LED "ALARM 2" lights when the insulation resistance of the IT system falls below the set response value *R*_{an2}.
- 5 Display The device display shows information regarding the device and the measurements.
- **6** Λ Navigates up in a list or increases a value.
- 7 MENU Opens the device menu
- ESC Cancels the current process or navigates one step back in the device menu.
- 8 RESET Resets alarms.
 - Navigates backwards (e.g. to the previous setting step) or selects a parameter.
- 9 TEST Starts the device self test.
 - Navigates forwards (e.g. to the next setting step) or selects a parameter.
- 10 DATA Indicates data and values.
 - V Navigates down in a list or reduces a value.
- **11** INFO Shows information.
 - OK Confirms an action or a selection.

Wiring diagram





- 1 Connection to an AC system U_n
- 2 Connection to a DC system U_n
- 3 Connection to an IT system with coupling device
- 4 Connection to a 3(N)AC system
- 5 Connection to the IT system to be monitored (L1/+, L2, L3/-)
- 6 Separate connection of KE, E to PE
- 7 (K1) Alarm relay 1, available changeover contacts
- 8 (K2) Alarm relay 2, available changeover contacts

- 9 Switchable resistor R for RS-485 bus termination
- 10 Ethernet interface
- 11 Digital interface
- For systems > 690 V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided.

Recommendation: 2A screw-in fuses.

Provide line protection!

According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

NOTE:

According to DIN VDE 0100-430, devices for protection against a short-circuit can be omitted for the coupling of terminals L1/+, L2, and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short-circuit to a minimum. (Recommendation: Ensure short-circuit-proof and earth-fault-proof wiring).

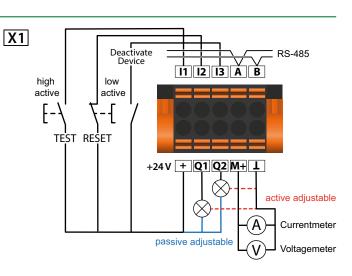
The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

For UL applications:

Use 60/70°C copper lines only! UL and CSA application require the supply voltage to be protected via 5 A fuses.

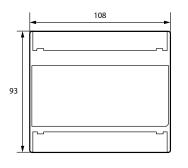
Digital interface X1

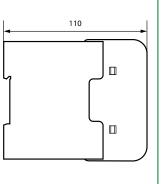
Digital interface	Terminal	Colour
	11	Input 1
	12	Input 2
	13	Input 3
	A	RS-485 A
11 12 13 A B + Q1 Q2 M+ L X1	В	RS-485 B
	+	+24 V
	Q1	Output 1
	Q2	Output 2
	M+	Analogue output
	T	Ground



Dimension diagram iso685-...

Dimensions in mm





Dimension diagram Panel cut-out FP200

Dimensions in mm

Connection to FP200



Technical data

Insulation coordination according to IEC 60	664-1/IEC 60664-3
Definitions:	
Measuring circuit (IC1)	(L1/+, L2, L3/-
Supply circuit (IC2)	A1, A2
Output circuit 1 (IC3)	11, 12, 14
Output circuit 2 (IC4)	21, 22, 24
Control circuit (IC5)	(E, KE), (X1, ETH, X3, X4
Rated voltage	1000 \
Overvoltage category	
Rated impulse voltage:	
IC1/(IC2-5)	8 k)
IC2/(IC3-5)	4 k)
IC3/(IC4-5)	4 k)
IC4/IC5	4 k)
Rated insulation voltage:	T K
IC1/(IC2-5)	1000
IC2/(IC3-5)	250
IC3/(IC4-5)	250
IC4/IC5	250
Pollution degree for accessible parts on the outside of	
Pollution degree for accessible parts on the outside of	
Protective separation (reinforced insulation) betw	
IC1/(IC2-5)	Overvoltage category III, 1000
IC2/(IC3-5)	Overvoltage category III, 300
IC3/(IC4-5)	Overvoltage categoryIII, 300
IC4/IC5	Overvoltage category III, 300
Voltage test (routine test) according to IEC 61010)-1:
IC2/(IC3-5)	AC 2,2 k
IC3/(IC4-5)	AC 2,2 kV
IC4/IC5	AC 2,2 kV
Supply voltage	
Supply via A1/+, A2/-:	
Supply voltage range Us	AC/DC 24240 \
Tolerance of U _s	-30+15%
Maximum permissible input current of Us	650 m/
Frequency range of $U_{\rm s}$	DC, 50400 Hz
Tolerance of the frequency range of U _s	-5+15%
Power consumption, typically DC	≤ 12 V
Power consumption, typically 50/60 Hz	≤ 12 W/21 V/
Power consumption, typically 400 Hz	≤ 12 W/45 V/
	_ 12 W/H5 W
Supply via X1:	
Supply voltage Us	DC 24
Tolerance of Us	DC -20+25 %
IT system being monitored	
Nominal system voltage range Un	AC 0690
	DC 01000 \
	AC/DC 0600 V (for UL applications
Toloropeo of II	AC/DC 0000 V (101 0L applications AC/DC +15 %
Tolerance of U_n	
Frequency range of U_n	DC, 0.1460 H
	0.14 Hz $U_{\sim \max} = 50 \text{ V/Hz}^2 * (1 + f_n^2)$
Max. AC voltage U_{\sim} in the frequency range $f_{\rm n} = 0$	
Response values Response value R _{an1} (alarm 1)	1 kΩ10 MΩ
Response values Response value R _{an1} (alarm 1)	
Response values Response value R _{an1} (alarm 1) Response value R _{an2} (alarm 2)	1 kΩ10 MΩ
Response values Response value <i>R</i> _{an1} (alarm 1) Response value <i>R</i> _{an2} (alarm 2) Relative uncertainty (acc. to IEC 61557-8)	1 k Ω 10 M Ω profile dependent, ±15 %, at least ±1 k Ω
Max. AC voltage U_{\sim} in the frequency range $f_n = 0$ Response values Response value R_{an1} (alarm 1) Response value R_{an2} (alarm 2) Relative uncertainty (acc. to IEC 61557-8) Hysteresis Time response	1 kΩ10 MΩ 1 kΩ10 MΩ profile dependent, ±15 %, at least ±1 kΩ 25 %, at least 1 kΩ
Response values Response value R _{an1} (alarm 1) Response value R _{an2} (alarm 2) Relative uncertainty (acc. to IEC 61557-8) Hysteresis Time response	$1k\Omega\dots 10M\Omega$ profile dependent, ± 15 %, at least $\pm 1k\Omega$ 25 %, at least $1k\Omega$
Response values Response value R _{an1} (alarm 1) Response value R _{an2} (alarm 2) Relative uncertainty (acc. to IEC 61557-8) Hysteresis Time response	1 kΩ10 MΩ profile dependent, ±15 %, at least ±1 kΩ 25 %, at least 1 kΩ 25 %, at least 1 kΩ 25 %, at least 1 kΩ) and $C_e = 1 \mu F$ according to IEC 61557-8
Response values Response value R_{an1} (alarm 1) Response value R_{an2} (alarm 2) Relative uncertainty (acc. to IEC 61557-8) Hysteresis Time response Response time t_{an} at $R_F = 0.5 \times R_{an}$ ($R_{an} = 10 \text{ k}\Omega$	$1 \text{ k}\Omega10 \text{ M}\Omega$ profile dependent, ±15 %, at least ±1 kΩ 25 %, at least 1 kΩ $25 \text{ %, at least 1 k}\Omega$) and $C_e = 1 \mu$ F according to IEC 61557-8 profile dependent, typ. 4 s (see diagrams in manual
Response values Response value R _{an1} (alarm 1) Response value R _{an2} (alarm 2) Relative uncertainty (acc. to IEC 61557-8) Hysteresis Time response	1 kΩ10 MΩ profile dependent, ±15 %, at least ±1 kΩ 25 %, at least 1 kΩ 25 %, at least 1 kΩ 25 %, at least 1 kΩ) and $C_e = 1 \mu$ F according to IEC 61557-8

Measuring circuit	
Measuring voltage U _m	profile dependent, $\pm 10 \text{ V}$, $\pm 50 \text{ V}$ (see profile overview)
Measuring current Im	≤ 403 μA
Internal resistance R _i , Z _i	≥ 124 kΩ
Permissible extraneous DC voltage U _{fg}	≤ 1200 V
Permissible system leakage capacitance Ce	profile dependent, 01000 μF

Measuring ranges

Measuring range <i>f</i> _n	0,1460 Hz
Tolerance measurement of f _n	±1 % ±0.1 Hz
Voltage range measurement of f _n	AC 25690 V
Measuring range Un	AC 25690 V
	DC 251000 V
Voltage range measurement of Un	AC/DC > 10 V
Tolerance measurement of Un	±5 % ±5 V
Measuring range C _e	01000 μF
Tolerance measurement of Ce	±10 % ±10 μF
Frequency range measurement of C _e	DC, 30460 Hz
Min_insulation resistance measurement of C.	

depending on the profile and coupling mode, typ. > 10 $k\Omega$

Display

Indication	graphic display 127 x 127 pixels, 40 x 40 mm ²⁾
Display range measured value	0.1 kΩ20 MΩ
Operating uncertainty (according to IEC 61557-8)	± 15 %, at least ± 1 k Ω

LEDs

ON (operation LED)	green
SERVICE	yellow
ALARM 1	yellow
ALARM 2	yellow

In-/Outputs (X1-Interface)

Cable length X1 (unshielded cable)	≤ 10 m
Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended:	
J-Y(St)Y min. 2x0,8)	\leq 100 m
Total max. supply output current for each output (device supplied by X1.+/X1.GND)	max. 1 A
Total max. supply output current on X1 (device supplied by A1+/A2-)	max. 200 mA
Total max. supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V)	
$I_{\text{LmaxX1}} = 10 \text{ mA}$	$+7 \text{ mA/V} * U_{s}^{3}$
(negative values are not all	owed for I _{LmaxX1})

Digital Inputs (I1, I2, I3)	
Number	3
Operating mode, adjustable	active high, active low
Functions	off, test, reset, deactivate device, start initial measurement
Voltage	Low DC -35 V, High DC 1132 V
Tolerance Voltage	±10 %

Digital Outputs (Q1, Q2)

Number	2
Operating mode, adjustable	active, passive
Functions	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm 4),
	DC+ alarm ⁴⁾ , symmetrical alarm, device fault, common alarm,
	measurement complete, device inactive, DC offset alarm
Voltage	passive DC 032 V, active DC 0/19.232 V
Analogue Output (M+)	
Number	1
Operating mode	linear, midscale point 28 k Ω /120 k Ω
Functions	insulation value, DC offset
Current	020 mA (< 600 Ω), 420 mA (< 600 Ω), 0400 μ A (< 4 kΩ)

±20 %

Voltage Tolerance related to the current/voltage final value $0...10 \text{ V} (> 1 \text{ k}\Omega), 2...10 \text{ V} (> 1 \text{ k}\Omega)$

0.25...0.75 mm²

Technical data (continued)

Multiple conductor, flexible

Multiple conductor, flexible with ferrule without plastic sleeve

Multiple conductor, flexible with TWIN ferrule with plastic sleeve

Technical adta (continue						
Interfaces						
Field bus:						
Interface/protocol			v	veb server	/Modbus T	CP/BCOM
Data rate				10/10	0 Mbit/s, au	utodetect
Max. amount Modbus requests						< 100/s
Cable length						≤ 100 m
Connection						RJ45
Paddress				DHCP/	manual 19	
Network mask						55.255.0
BCOM address						stem-1-0
Function				comr	nunication	
Sensor bus:						internace
Interface/protocol				DC_/	185/BS/Mo	dhuc DTI
Data rate				1.5 -		kBaud/s
Cable length						≤ 1200 m
Cable: twisted pair, one end of shield co	nnoctod to	DE	racar	nmandad	: J-Y(St)Y m	
Connection	innecteu to	ΓĽ	Tecor		terminals X	
Ferminating resistor at the beginning a	nd at the e	ad of the t	rancmiccio			1.A, A1.D
reminating resistor at the beginning a	inu at the ei	iu oi the t			connected i	ntornally
Device address DC hus			1201	2, can be o	connected i	•
Device address, BS bus						190
Switching elements						
Number of switching elements				2 (changeover	contact
Operating mode					ation/N/O o	
Contact 11-12-14/21-22-24	off Ins a	alarm 1 In	s alarm 2		n fault, DC-	
	DC+ alarm					
•					tive, DC off:	
Electrical endurance under rated operat					uve, de on	10.000
· · ·	ing condition	JIIS, Hullis	ci oi cycic.	•		10.000
Contact data acc. to IEC 60947-5-1:						
Jtilisation category	AC-13	AC-14	DC-12	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	48 V	110 V	220 \
Rated operational current	5 A	3 A	1 A	1 A	0.2 A	0.1 A
Rated insulation voltage \leq 2000 m NN						250 V
Rated insulation voltage \leq 3000 m NN						160 \
Minimum contact rating				1	mA at AC/D	$C \ge 10 V$
Condiciones Ambientales/Compatik	oilidad ele	ctromagi	nética			
CEM					IEC 613	26-2-4 5
Ambient temperatures:						
Operating temperature					-25	+55 °C
Fransport						+85 °C
Long-term storage						+70 °C
3					т u .	
Classification of climatic conditions	acc. to IE					<i>(</i> ,)
Stationary use (IEC 60721-3-3)		3K23 (e	xcept cond	ensation a	nd formati	
Transport (IEC 60721-3-2)						2K11
Long-term storage (IEC 60721-3-1)						1K22
Classification of mechanical conditi	ions acc. to	o IEC 6072	21:			
Stationary use (IEC 60721-3-3)						3M11
Transport (IEC 60721-3-2)						2M4
ong-term storage (IEC 60721-3-1)						1M12
Area of application					≤ 30	00 m NN
Connection						
Connection type	ри	lggable sc	rew-type t	erminal or	push-wire	termina
Screw-type terminals:						
Nominal current				0.5	D.C.N. (5	≤ 10 A
Fightening torque				0.5(0.6 Nm (5.	
Conductor sizes					AV	VG 24-12
Stripping length						7 mm
rigid/flexible						2.5 mm
flexible with ferrules, with/without plas	stic sleeve					2.5 mm
Multiple conductor, rigid						1 mm
Multiple conductor flevible					0.2	15 mm

Push-wire terminals:	
Nominal current	≤ 10 A
Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.22.5 mm ²
flexible with ferrules, with/without plastic sleeve	0.252.5 mm ²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.51.5 mm ²
Push-wire terminals X1:	
Nominal current	≤ 8 A
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.21.5 mm ²
flexible with ferrule without plastic sleeve	0.25. 1.5 mm ²

Other

Operating mode	continuous operation
Mounting (0°)	display oriented, cooling slots must be ventilated vertically 6)
Degree of protection internal componer	its IP40
Degree of protection terminals	IP20
DIN rail mounting acc. to	IEC 60715
Screw fixing	3 x M4 with mounting clip
Enclosure material	polycarbonate
Flammability class	V-0
ANSI code	64
Dimensions (W x H x D)	108 x 93 x 110 mm
Weight	< 390 g

Option "W" data different from the standard version

flexible with TWIN ferrule with plastic sleeve

max. 3 A (for UL applications)			
-40…+70 °C			
-40+65 °C (for UL applications)			
-40…+85 °C			
-40…+70 °C			
IEC 60721:			
onary use (IEC 60721-3-3) 3K23 (condensation and formation of ice possi			
5			

Stationary use (IEC 60721-3-3) 3M12 ¹⁾ At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices

- which at least have overvoltage category CAT2 (300V) may be connected.
- $^{2)}\;$ Indication limited outside the temperature range -25 \ldots +55 °C.
- ³⁾ $U_{\rm s}$ [Volt] = supply voltage ISOMETER[®]

0.2...1.5 mm²

0.25...1 mm²

0.5...1.5 mm²

- ⁵⁾ This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.
- ⁶⁾ Recommendation: Devices mounted at 0 ° (display-oriented, cooling slots must be ventilated vertically). For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C. For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.

⁴⁾ For $U_n \ge 50$ V only.

Ordering information

Nominal system voltage range U _n		Supply voltage U _s		Display	Option "W"	Туре		Art. No.	
AC	DC	AC	DC	Display			type		
0690 V; 0.1460 Hz		24240 V;		integrated	-	iso685-D		B91067010	
					-40+70 °C, 3K23, 3M12	iso685W-D		B91067010W	
		50400 Hz	24240 V	detached	-	iso685-S + FP200		B91067210	
					-40+70 °C, 3K23, 3M12	iso685W-S + FP200W		B91067210W	

Accessories

Description	Art. No.
Description	AFL. NO.
A set of screw terminals ¹⁾	B91067901
A set of push-wire terminals	B91067902
Enclosure accessories (terminal cover, 2 mounting clips) ¹⁾	B91067903
Transparent cover 144x72 (IP65) for FP200 ²⁾	B98060005

¹⁾ included in the scope of delivery

 $^{2)}~$ If the "transparent front cover 144x72 (IP65)" is used, the cutout in the control cabinet must be increased in height from 66 mm to 68 mm (+ 0.7 / -0 mm).

Suitable system components

Description	Туре	Art. No.
Davica varcian without dicplay	iso685-S	B91067110
Device version without display	iso685W-S	B91067110W
Dicular for front nanal mounting	FP200	B91067904
Display for front panel mounting	FP200W	B91067904W
	AGH150W-4	B98018006
Counting designs	AGH204S-4	B914013
Coupling devices	AGH520S	B913033
	AGH676S-4	B913055

Suitable measuring instruments on request!



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