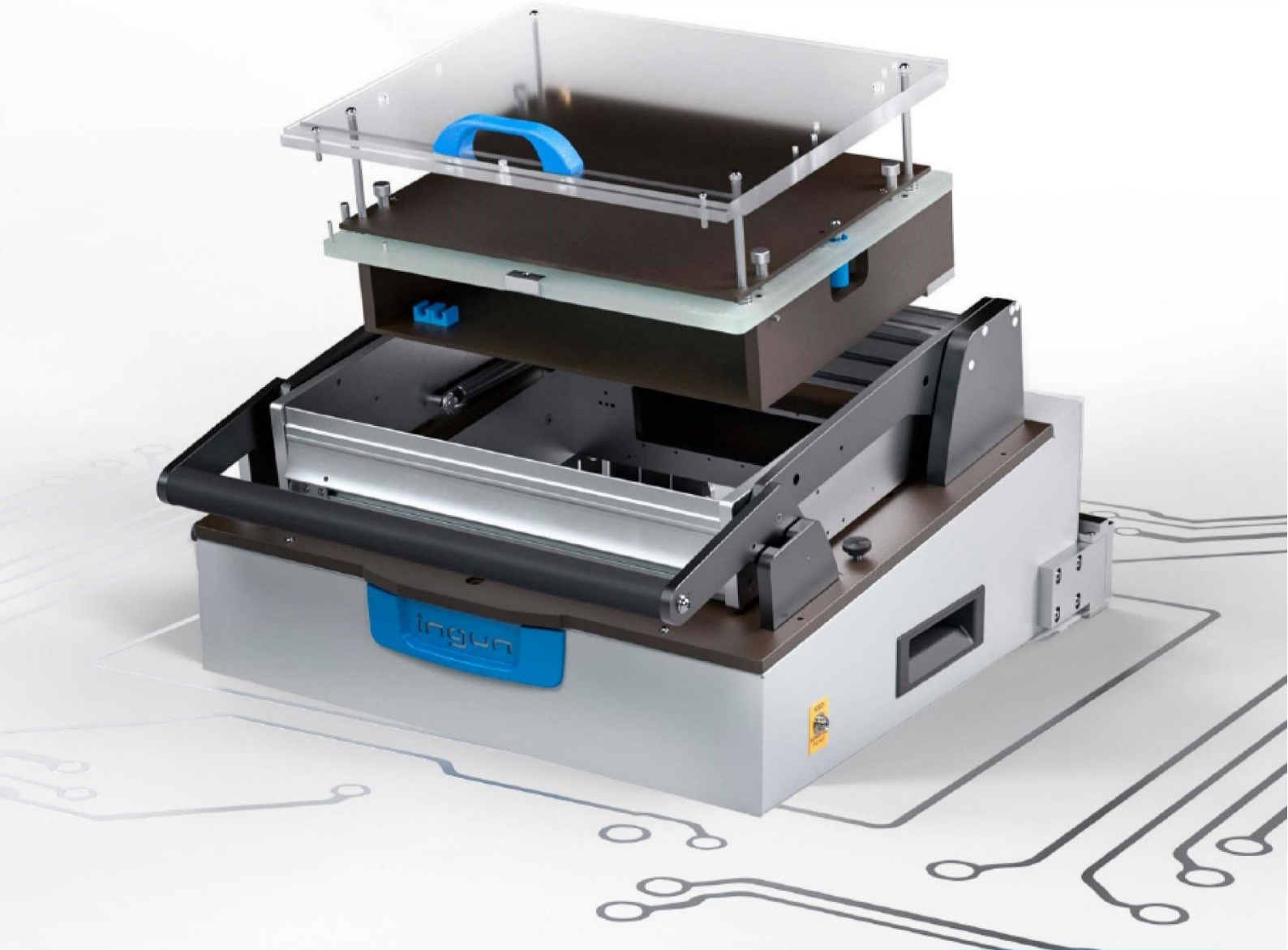
ingun®
Partner for Future Technology

NO.1 IN TESTING SOLUTIONS

Technical manual

Manual Test Fixture



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1 Product description 6
1.1 MA xxx 6
1.1.1 ATS MAxxx 6
1.1.1.1 Standard version 6
1.1.1.2 ESD version 6
1.2 MA xxxx 7
1.2.1 ATS MAxx 8
1.2.1.1 Standard version 8
1.2.1.2 ESD version 8
1.2.1.3 RF version 9
1.3 MA xxxx indvidual modules 9
1.3.1 Drive units 10
1.3.2 Housings 10
1.3.3 Rear panels and interface supports 10
1.3.4 Base plate units and interface supports 11

2 Safety 11
2.1.1 Safety advice for testing with harmless high voltage 11
2.1.2 Air distance and maximum permissible current: 11
2.1.3 Commissioning of safety functions 11
2.1.4 Hazards when operating electromagnets 13

3 Customisation 13
3.1 ESD (Electrostatic discharge) 14
3.1.1 ESD-safe test fixtures 14
3.1.2 ESD-compliant materials 14
3.1.3 ESD quality control 15
3.2 Customising for stroke 22 mm (MA 3xxx) 15
3.3 Customising accessories 15
3.3.1 Interface blocks (SB) 15
3.3.2 Start-up kit (SK) 16
3.3.3 Side approach mechanism (SAM) 16
3.3.4 Marking units (ME) 16
3.3.5 Potentiometer screwing unit/ button activators 16
3.4 Precision customisation with guide plate 16
3.5 INGUN S-Line series 17
3.5.1 S-Line kits (SBU-...-ATSMAxx) for standard customisation 18
3.5.2 S-Line kits (SBU-...-WL-ATSMAxx) for wireless customisation 18
3.6 Rigid pin version 18
3.6.1 Rigid pin cassette (SNK) 18
3.6.2 Rigid pin cover (SNH) 19
3.7 Customisation for inline systems 19
3.7.1 CRS test station 19
3.7.2 KABTEC test station 19

4 Functional sequence 20

5 Optional Functional units 21
5.1 Optional functional units MA xxx 21
5.1.1.1 FB-ESD-MAxxx ESD customisation 21
5.1.1.2 Rear panel with cut-out for cables 21
5.1.1.3 Base plate 22
5.1.1.4 Adjustable feet for applications without housing (pack of 4) 22
5.1.1.5 Gas pressure spring to secure open pressure frame plate 22
5.1.1.6 Drive unit 22
5.1.1.7 VG male multipoint connector set (64-pole) 22
5.1.1.8 VG male multipoint connector set (96-pole) 22
5.2 Optional functions MA xxxx 22
5.2.1 FB-SLV-MA: Protection conductor wiring and contact protection for hazardous voltages 22
5.2.2 FB-ESD-MA: ESD assembly 23
5.2.3 FB-ESD-S-MA: ESD assembly and protection conductor wiring 24
5.2.4 FB-2VM-MA: Dual-stage contacting from bottom side (no self-opening) 24
5.2.5 FB-2VM-SO: Dual-stage contacting with self-opener 26
5.2.6 Safety switch for closed pressure frame 28
5.2.6.1 FB-SIS-ZSO-MA: Safety switch with solenoid interlock NO (currentless; open) 29
5.2.6.2 FB-SIS-ZSG-MA: Safety switch with solenoid interlock NC (currentless; closed) 30
5.2.6.3 FB-SIS-MA: Safety switch without solenoid interlock 31
5.2.6.4 FB-SIS-BM-MA: Magnetic safety switch 32
5.2.7 Self-opening units 33
5.2.7.1 FB-SOP-MA: Pneumatic self-opening unit 34
5.2.7.2 FB-SOE-MA: Electrical self-opening unit 35
5.2.8 Automatic opener/closer 36
5.2.8.1 FB-OSA-E-MA: Electric automatic opener/closer 37
5.2.8.2 FB-SIS-OSA-MA: Safety switch 38
5.2.8.3 FB-STE-OSA-E: Electronic control unit 39
5.2.9 Closed pressure frame unit detection 40
5.2.9.1 FB-ABF-G-S-MA: Check with stroke switch 40
5.2.9.2 FB-ABF-G-I-MA: Stroke position detection with inductive sensor 41
5.2.9.3 FB-ABF-V-I-MA: Locking position detection with inductive sensor 41
5.2.10 FB-ABF-V-SKS-MA: Locked ATS detection 41
5.2.11 Locking unit for closed pressure frame 42
5.2.11.1 FB-VER-G-ESG-MA: Stroke magnet NC (currentless; closed) 42
5.2.11.2 FB-VER-G-ESO-MA: Stroke magnet NO (currentless; open) 43
5.2.11.3 FB-VER-G-P-MA: Pneumatic cylinder locking 43
5.2.12 FB-VER-O-ESO-MA: Locking unit for open pressure frame 44
5.2.13 FB-OBR-MA: Open pressure frame unit stop limit 45
5.2.14 FB-GDF-MA: Gas pressure spring spare parts kit 45
5.2.15 FB-GDF-xxxN-MA: Gas pressure springs for drive unit (kit) 46
5.2.16 FB-MGK-MA: Hinged metal handle 46
5.2.17 FB-LED-MA: Pass / fail LED indicator 46
5.2.18 FB-ADT-MA: Push button 47
5.2.19 FB-OLB-MA: Oil break 47

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5.2.20 FB-KSG-MA: Anti-pinch protection 47
5.2.21 FB-VLK-MA: Extended handle 48
5.2.22 FB-STE-LED-MAxxxx LED-Dimmer (113999) 48
5.2.23 FB-STE-UNI-MA: MA control unit 48
5.2.24 FB-STE-MAG-MA: Magnet control unit 50

6 Additional Functional units ATS MAxx 52
6.1 ATS MAxx ../ESD: ESD version 52
6.2 ATS MAxx ../HF: Radio-frequency version 53

7 Optional functional units for ATS 54
7.1 FB-2SN-ATS: Dual-stage upgrade kit 54
7.2 Reinforcement for customisations with large number of test points 55
7.2.1 FB-VSL-NDH-ATS: Reinforcement set for pressure frame plate (NDH) 55
7.2.2 FB-VSL-KTE-ATS: Reinforcement set for probe plate unit (KTE) 55
7.3 FB-ELS-22-ATS: Insertion blocker for 22mm stroke 56
7.4 FB-BSP-ATS: Protective cover for hazardous voltage 56
7.5 FB-AHE-ATS: Lifting units 57
7.6 Closed pressure frame detection 58
7.6.1 FB-ABF-G-GKS-ATS: Closed pressure frame detection using two GKS 58
7.6.2 FB-ABF-K-S-ATS : Closed for pressure frame detection with stroke switch 58
7.7 Actuator for safety switch with and without locking 59
7.7.1 FB-BTV-ATS: Actuator for single-stage contacting 59
7.7.2 FB-BT2-ATS: Actuator for dual-stage contacting (basic unit) 59
7.7.3 FB-BTM-ATS: Actuator for magnetic safety switch 60
7.8 MAP-ATSMA: Ground plate for exchangeable kits (ATS) 60
7.9 Contacting from top side (mounting kit) 61
7.9.1 FB-ZSK-ATS; Standard exchangeable kits 61
7.9.2 FB-ZSK-ESD-ATS: ESD exchangeable kits 61

8 Further maintenance 61
8.1 ATS alignment check 61
8.2 Replacement parts and worn parts MA xxxx 62

9 Technical Data 63
9.1 Specification of components used 63
9.1.1 Stroke switch (part number 20202) 63
9.1.2 Inductive sensor (part number 26466) 63
9.1.3 Inductive sensor M8x1 (part number 33831) 63
9.1.4 Inductive sensor (part number 36684) 63
9.1.5 Inductive sensor (part number 38413) 64
9.1.6 Inductive sensor (part number 44833) 64
9.1.7 Inductive sensor (part number 111136) 64
9.1.8 Stroke magnet NC (currentless; closed) (part number 28194) 64
9.1.9 Stroke magnet NO (currentless; open) (part number 33491) 65
9.1.10 Valve assembly 3/2-way (part number 43583) 65
9.1.11 Valve assembly 5/2-way (part number 42702) 65

9.1.12 Pneumatic cylinder 12-10 (part number 49273) 65
9.1.13 Pneumatic cylinder 12-10 (part number 43251) 66
9.1.14 Pneumatic cylinder 12-10 (part number 49273) 66
9.1.15 Pneumatic cylinder 25-50 (part number 39203) 66
9.1.16 Pneumatic cylinder 32-10 (part number 39673) 66
9.1.17 Pneumatic cylinder 32-30 (part number 28235) 66
9.1.18 Compressed air combination (part number 14241) 67
9.1.19 Brake cylinder D-040-12-040-123 (part number 51863)....67
9.1.20 LED SMD strip green (part number 45673) 67
9.1.21 LED SMD strip red (part number 45674)....67
9.1.22 Push button yellow (part number 33466)....67
9.1.23 Push button red (part number 33467) 67
9.1.24 Push button green (part number 33468)....67
9.1.25 Valve mounting part (part number 57022)....68

10 Compatibility matrix 69

11 Customising guidelines 70

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1 PRODUCT DESCRIPTION

1.1 MA xxx

Designation convention:

MA	2	60	/F
			Option: **/F** flat housing
		Size: **50** Useable area 100 x 90 mm **60** Useable area 160 x 100 mm	
	Versions: **2** Small-series fixture **3** Small-series fixture with lever handle		
MA Manual test fixture			

Basic unit

Designation	Part no.
MA 260/F	40600

Designation	Part no.
MA 350/F	46100
MA 360/F	45650

1.1.1 ATS MAxxx

Designation convention:

ATS MA	2	60	/ESD
			Option: **/ESD** ESD version
		Size: **50** Useable area 100 x 90 mm **60** Useable area 160 x 100 mm	
	Versions: **2** Small-series fixture **3** Small-series fixture with lever handle		
Exchangeable kit for manual test fixture			

Exchangeable kits

Basic unit	*1.1.1.1 Standard version*		*1.1.1.2 ESD version*	
	Designation	Part number	Designation	Part number
MA 160	ATS MA160	28385-KIT	ATS MA160	30800-KIT
MA 260	ATS MA260	41220-KIT	ATS MA260	41225-KIT
MA 350	ATS MA350	46480-KIT	ATS MA350	46490-KIT
MA 360	ATS MA360	45669-KIT	ATS MA360	46200-KIT

1.2 MA xxxx

Designation convention:

MA	2	1	13	T/D/H/S-10
				Options: **T** = tandem version **/D** = desk (desk housing) / F = flat housing **/H** = fixing drive unit H = hinge " " = firmly screwed together **/S-n** = Number of interface blocks (5 – 10) / " " = no interface **/HG** = high housing / " " = standard housing **/tester-interface**: see matrix in test fixture catalogue
			size: **09 – 15**	
		Version: **0** without interface **1** standard with interface **2** heavy-duty version		
	Generation: **2** MA with stroke 14mm **3** MA with stroke 22mm			
Manual test fixture				

Basic units with internal interface and without test system interface

Description	Part number
MA 2109/D/H/S-5	34340
MA 2111/D/H/S-5	31730
MA 2111/D/H/S-5/HG	33420
MA 2112/D/H/S-7	32660
MA 2112/D/H/S-7/HG	33460
MA 2113/D/H/S-10	32500
MA 2113/D/H/S-10/HG	32700
MA 2113T/D/H/2xS-5	32300
MA 2113T/D/H/2xS-5/HG	36666
MA 2114/D/H/S-10	34350
MA 2115/D/H/S-14	116000
MA 3211/D/H/S-5	43950
MA 3212/D/H/S-7	43630
MA 3213/D/H/S-10	43580
MA 3213T/D/H/2xS-5	43970
MA 3214/D/H/S-10	43960

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1.2.1 ATS MAxx

Designation convention:

ATS MA	14	/S-10
		Options: **-2** Dual-stage version (only for pneumatic upgrade kit) **/S-n** Number of interface blocks (5 – 10) / " " = no interface **/ESD** ESD version **/RF** Radio-frequency **/SN** Rigid pin
	Version: **09 – 15**	
Exchangeable kit MA		

1.2.1.1 Standard version

Basic unit	**With** internal interface		**Without** internal interface	
	Designation	Part number	Designation	Part number
MA 2x09	ATS MA09/S-5	45990-KIT	ATS MA09	45994-KIT
MA xx11	ATS MA11/S-5	45898-KIT	ATS MA11	45900-KIT
MA xx12	ATS MA12/S-7	45903-KIT	ATS MA12	45904-KIT
MA xx13	ATS MA13/S-10	45908-KIT	ATS MA13	45980-KIT
MA xx13T	ATS MA11/S-5	45898-KIT	ATS MA11	45900-KIT
MA xx14	ATS MA14/S-10	45983-KIT	ATS MA14	45985-KIT
MA xx15	ATS MA15/S-14	114779-KIT	-	-

The ATS is delivered as a kit and therefore is not assembled.

1.2.1.2 ESD version

Basic unit	**With** internal interface		**Without** internal interface	
	Designation	Part number	Designation	Part number
MA 2x09	ATS MA09/S-5/ESD	46233-KIT	ATS MA09	46245-KIT
MA xx11	ATS MA11/S-5/ESD	46026-KIT	ATS MA11	46248-KIT
MA xx12	ATS MA12/S-7/ESD	46236-KIT	ATS MA12	46250-KIT
MA xx13	ATS MA13/S-10/ESD	46239-KIT	ATS MA13	46254-KIT
MA xx13T	ATS MA11/S-5/ESD	46026-KIT	ATS MA11	46248-KIT
MA xx14	ATS MA14/S-10/ESD	46242-KIT	ATS MA14	46257-KIT
MA xx15	ATS MA15/S-14/ESD	116330-KIT	-	-

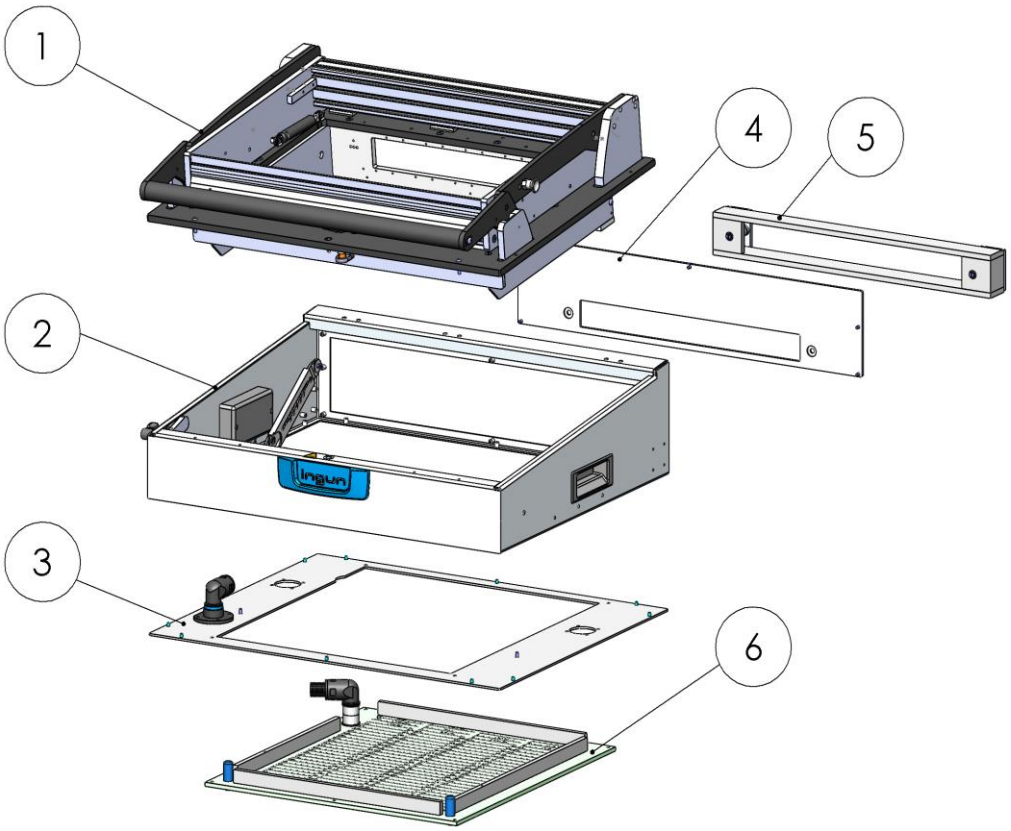
The ATS is delivered as a kit and therefore is not assembled. *(see section **6.1**, page 52).*

1.2.1.3 RF version

Basic unit	**With** internal interface		**Without** internal interface	
	Designation	Part number	Designation	Part number
MA xx11	ATS MA11/S-5/HF/AL/ESD	154111	ATS MA11/HF/AL/ESD	154011
MA xx12	ATS MA12/S-7/HF/AL/ESD	154112	ATS MA12/HF/AL/ESD	154012
MA xx13	ATS MA13/S-10/HF/AL/ESD	154113	ATS MA13/HF/AL/ESD	154013
MA xx13T	ATS MA11/S-5/HF/AL/ESD	154111	ATS MA11/HF/AL/ESD	154011
MA xx14	ATS MA14/S-10/HF/AL/ESD	154114	ATS MA14/HF/AL/ESD	154014
MA xx15	-	**-**	-	**-**

ATS is delivered fully assembled (see section **6.2**, page 53).

1.3 MA xxxx indvidual modules



Pos.	**Name**	**Designation**
1	Drive unit	ATE MA2113
2	Desk housing	PGH MA13/TDS
3	Base plate or interface support	BOE MA13 SSA-MTS300-MAxx13
4	Base plate or interface support	RWE MAxx13 SSA-PYLON-12
5	Interface	SST-PYLON-12
6	Interface	SST-MTS300

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1.3.1 Drive units

Designation	Part no.
ATE MA2009	105126
ATE MA2011	48372
ATE MA2012	48522
ATE MA2013	48370
ATE MA2014	100685
ATE MA2109	39900
ATE MA2111	36170

Designation	Part no.
ATE MA2112	35650
ATE MA2113	37790
ATE MA2114	38440
ATE MA2115	116500
ATE MA3212	43530
ATE MA3213	43570
ATE MA3214	43880

1.3.2 Housings

Designation	Part no.
PGH MA09/TDS/BG	114906
PGH MA11/TDS/BG	114907
PGH MA11/TDS/BG/HG	114908
PGH MA12/TDS/BG	114903
PGH MA12/TDS/BG/HG	114909

Designation	Part no.
PGH MA13/TDS/BG	114904
PGH MA13/TDS/BG/HG	114910
PGH MA14/TDS/BG	114905
PGH MA14/TDS/BG/HG	114912
PGH MA15/TDS/HG	115500

1.3.3 Rear panels and interface supports

Designation	Part no.
RWE MAxx09/11	114919
RWE MAxx12	114920
RWE MAxx13	114050
RWE MAxx14	114921
RWE MAxx15	115161
SSA-KMFT-MAxx12	114999
SSA-KMFT-MAxx13	114090
SSA-KS-i1000-MAxx13	115104
SSA-KT-ITA-21-MAxx12	115207
SSA-MCP-Scout-MAxx13	115107
SSA-MCP-Titan-MAxx12	114521
SSA-ODU-FOUR-M-MAxx12	112259
SSA-ODU-TWO-M-MAxx12	112257
SSA-PYLON-12-MAxx12	114031
SSA-PYLON-12-MAxx13	114030
SSA-PYLON-12-MAxx14	114033
SSA-PYLON-16-MAxx13	114035
SSA-PYLON-16-MAxx14	114037
SSA-VPC-9025-Maxx12	113920
SSA-VPC-9025-MAxx13	113943

Designation	Part no.
SSA-VPC-9025-MAxx14	113948
SSA-VPC-G12-MAxx13	113928
SSA-VPC-G12-MAxx14	114020
SSA-VPC-G12X-Maxx12	114022
SSA-VPC-G12X-MAxx13	114024
SSA-VPC-G12X-MAxx14	114026
SSA-VPC-G18-Maxx12	113975
SSA-VPC-G18-MAxx13	113984
SSA-VPC-G18-MAxx14	113986
SSA-VPC-G20-MAxx12	113971
SSA-VPC-G20-MAxx13	113969
SSA-VPC-G20-MAxx14	113966
SSA-VPC-G20X-MAxx12	113946
SSA-VPC-G20X-MAxx12/HG	114074
SSA-VPC-G20X-MAxx13	113952
SSA-VPC-G20X-MAxx13/HG	114068
SSA-VPC-G20XMAxx14	113961
SSA-VPC-G20X-MAxx14/HG	114072
SSA-VPC-G20X-RS-Maxx12	114056
SSA-VPC-S6-Maxx12	113981

1.3.4 Base plate units and interface supports

Designation	Part no.
BOE MA13	114923
SSA-88xx-M-MAxx13	115272
SSA-88xx-S-MAxx13	115215

Designation	Part no.
SSA-GR228x-15-MAxx13	113522
SSA-MTS300-MAxx13	114045
SSA-SEICA-MAxx13	113444

2 SAFETY

2.1.1 Safety advice for testing with harmless high voltage

Touching of parts under voltage is regarded as non-hazardous under the following conditions:
"At voltages with frequencies up to 500 Hz above AC 25V or DC 60V the evoked current is due to an inductive-free resistor of 2kOhm not greater than 3mA AC effective respectively 12mA DC" (DIN EN 50191, page5).



When testing voltages fulfil these conditions, the test fixture can be also operated with this high voltage. However, specialised wiring components must be chosen, and the wiring must be laid out for the air paths and creep paths required. For this reason, the additionally stated high-voltage and the applicable stated current rating on the label must not be exceeded.

2.1.2 Air distance and maximum permissible current:

The air distance is the shortest gap between two conductive components and definitive for the maximum permissible voltage of the applied interface block pairs. The main rule for the voltage flashover of sharp components in the air under standard conditions is:

for each mm distance approx. 0.8 kV.
(Max. permissible voltage at 170-pole Low Ohm Blocks, for example:
0.34 mm (air distance not wired) * 0.8 kV ≈ 270 V)

2.1.3 Commissioning of safety functions

The test fixture does not have its own control system. Therefore, the commissioning carried out by the customer also includes the evaluation and control of the safety-relevant switches and sensors. The demands on this part of the control unit are defined in the DIN EN ISO 13849-1 "Safety of machines; safety-related parts of the control unit – part 1: General design guideline".
According to the risk evaluation carried out by INGUN, the test fixture with pneumatic or electromagnetic functions presents the following risk evaluation:
In the risk assessment for test fixtures with pneumatic or electrical drive functions carried out at INGUN, the hazard is treated differently depending on the pressure (given by the geometry) and force (force of the moving parts). The respective classification is stated in the EC Declaration of Incorporation or EC Declaration of Conformity supplied with the test fixture.

No dangerous mechanical hazard (no damage, no injury)

Prerequisite: Forces ≤ 140 N and surface load ≤ 2 N/mm^2
Classification: No performance level, EN ISO 13849-1 is not applicable

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Minor mechanical hazard (minor injury possible)

Prerequisite: Forces ≤ 140 N and surface load ≤ 10 N/mm2



Caution: Risk of injury!!

Mechanical hazard from moving parts

Risk assessment *(in accordance with DIN EN ISO 13849-1, risk graph. pg. 55)*:

Severity of the injury	S = S1	slight (usually temporary)
Frequency of and/or exposure to hazard	F = F1	seldom to infrequent and/or exposure to hazard is short
Possibility of avoiding the hazard	P = P1	possible under certain circumstances

This leads to a necessary performance level PL of a.

Serious hazard

Prerequisite:Forces >140 N



Warning: Risk of injury!

Mechanical hazard from moving parts

Risk assessment *(in accordance with DIN EN ISO 13849-1, risk graph. pg. 55)*:

Severity of the injury	S = S2	slight (usually temporary)
Frequency of and/or exposure to hazard	F = F1	seldom to infrequent and/or exposure to hazard is short
Possibility of avoiding the hazard	P = P2	barely possible

This leads to a necessary performance level PL of d.

When using the **test fixture with low-voltage customisation,** the following risk evaluation is given:



Warning: Risk of injury!

Electrical hazard due to parts carrying voltage, overload, and parts, that are carrying voltage due to a faulty state

Risk evaluation *(according to DIN EN ISO 13849-1)*:

Severity of the injury	S = S2	serious (normally irreversible injury including death)
Frequency of and/or exposure to hazard	F = F1	seldom to infrequent and/or exposure to hazard is short
Possibility of avoiding the hazard	P = P2	barely possible

This leads to a necessary performance level PL of d.

For voltages greater than 240 Volt the wiring must be designed to take the necessary air and creepage paths into consideration. Therefore, the permitted voltage stated on the label must not be exceeded at any time.

Necessary additional functions:

⇒ FB-BSP-ATS: Protective cover for hazardous voltage (see section **5.2.1**, page 22)

⇒ Safety switch for closed pressure frame (see section **5.2.6**, page 28)

⇒ Actuator for safety switch with and without locking (see section **7.7**, page 59)

2.1.4 Hazards when operating electromagnets

Within some optional functional units, electromagnets are used to lock specific positions. When operating electromagnets with nominal voltage for a long time (>10 minutes) their outer surface gets very hot. The outer surface of electromagnets reaches high temperatures (70°C +) when nominal voltage is applied for an extended period of time (>10 minutes).



Warning: Danger of injury!

Thermal hazard resulting from hot surfaces

The electromagnets can heat up to 70° C when operated for a long time with full continuous power supply.

The electromagnetic should not be active when the fixture is not being used.

Halve the control voltage after approx. one second duty-cycle, i.e., connect the electromagnet with two channels each and connect a resistor in the channel for the constant current supply.

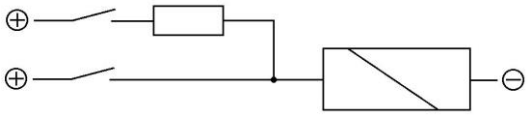


Figure 1: Activation with 2 channels

Find more details in the following sections:

- 9.1.8 Stroke magnet NC (currentless; closed) (part number 28194) side 64
- 9.1.9 Stroke magnet NO (currentless; open) (part number 33491) side 65

3 CUSTOMISATION

The ATS is especially customised for the PCBs/UUTs to be tested. Customising normally consists of spring-loaded test probes (which are installed in receptacles), the UUT/PCB centring, the UUT/PCB support pins, the pushrods, and possibly further customising parts. Should the UUT/PCB have side-connectors that need to be contacted, the ATS will additionally be equipped with a connector approach mechanism (SAM).

The customising of the ATS requires care, as well as a lot of experience. High forces can occur when there is a large number of test points. These forces can lead to deformation of the probe plate and the pressure frame plate. Furthermore, asymmetrical positioning of the test probes may require additional reinforcement of the unit.

More information available:	**INFO 1317:** ATS MAxx series customising guidelines

WARNING: When customising for use with dangerous voltages, care must be taken to ensure that all cables carrying dangerous voltages are kept as short as possible and, if necessary, also fixed in place. (This will prevent cables from coming into contact with operating elements in the front area of the test fixture in case of possible cable breakage).

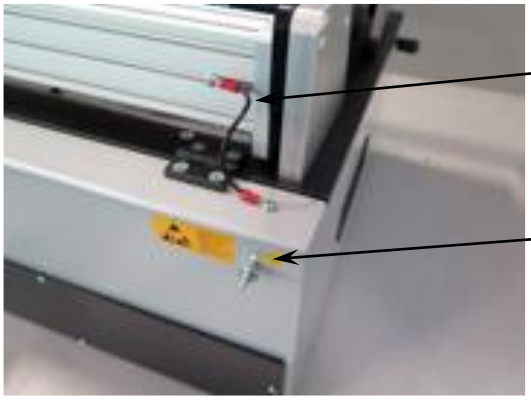
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3.1 ESD (Electrostatic discharge)

Electrostatic discharge (ESD) refers to the flow of electrical current resulting from potential differences, which causes a short, high electrical voltage pulse and, under certain circumstances, can permanently damage components that are sensitive to overvoltage or surge.

3.1.1 ESD-safe test fixtures

In order to protect sensitive components from damage caused by ESD, especially during testing, a test fixture is equipped with specialised ESD wiring (black cables) as well as an earthing connection and a connection for an ESD antistatic strap.



Only ESD-compliant materials and coatings are used for exchangeable kits and customising accessories. The basis for the selection of ESD-compliant materials is DIN 61340-5-1 (Protection of electronic devices from electrostatic phenomena), which specifies a surface resistance of $<10^9$ Ω for work surfaces and dissipative materials with a surface resistance typically between $> 10^5$ Ω and $< 10^{11}$ Ω They equalise potential differences in a relatively short time. (see, for example, the ESD-guidelines from WETEC - in German only).

NOTE: ESD protection against ESD is only ensured if the test fixture's earthing connection is connected to a common earthing point that connects all conductive components of a workstation to each other and dissipates them to earth in a controlled manner.

ESD-compliant push rods and PCB support pins are electrostatically dissipative (non-conductive). They should ideally be positioned to ensure there is no contact with conductive PCB tracks.

3.1.2 ESD-compliant materials

Dissipative materials (conductive materials) with defined electrical conductivity properties can permanently dissipate electrostatic charges in a controlled manner within a defined period of time. Typical values for the materials and coatings we use are:

ADAPTONITE (FR3)	$\geq 10^6$ to $< 10^{10}$ Ω
ESD-coating	$\geq 10^5$ to $< 10^9$ Ω
PLEXIGLAS®	$\geq 10^6$ to $< 10^7$ Ω

3.1.3 ESD quality control

The ESD configuration can be checked using an electrostatic field meter to ensure it is correct. The ESD test fixture must be connected to earth via its earthing connection. The charge can be transferred, for example to the pressure plate (ADP), using a plastic film that is charged by moving it back and forth between your hand. The field measuring device can be used to observe the transfer of voltage. The voltage level to be achieved can vary greatly depending on humidity, temperature, properties of the film used, or other factors. Regardless of the voltage applied, the measured value will be < 50 V/cm within twenty seconds after the charge is applied.



3.2 Customising for stroke 22 mm (MA 3xxx)

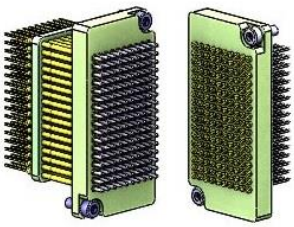
The standard stroke is 14 mm. This ATS, which is especially customised for the MA 3xxx - 22 mm stroke, cannot be used in the MA 2xxx. The 22 mm stroke ATS is equipped with a special insertion blocker in order to prevent improper use *(see section **7.3**, page 56).*

3.3 Customising accessories

Within its wide range of customising accessories, INGUN offers a great variety of matching small parts and functional units for standard customising, as well as for application-specific customising. The following overview shows only some of the various functional units:

3.3.1 Interface blocks (SB)

INGUN interface blocks are used as electrically conductive connectors for the reliable signal transfer in internal, external, and customised interfaces. Loaded with spring-loaded test probes, the matching contact strokes guarantee consistently low contact resistance and constant reliable contact quality. The working space is 15.1 ± 0.5 *(see catalogue page 155-170).*



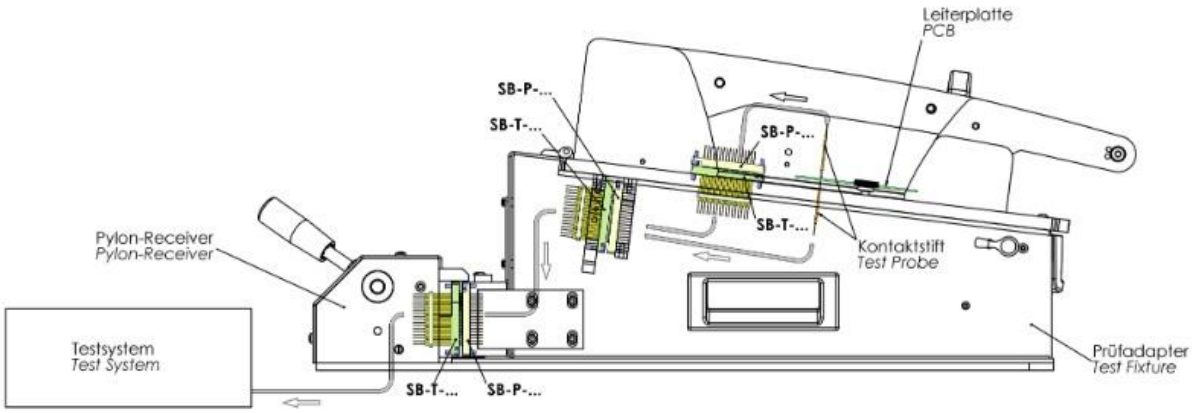


Figure 2: Example of interface block installation

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3.3.2 Start-up kit (SK)



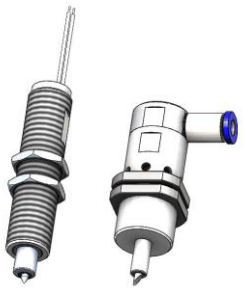
INGUN offers various start-up kits for independent on-site customising of the ATS. These start-up kits include all popular components required for customisation – from the pre-centring pins to spring-loaded test probes (see catalogue page 154).

3.3.3 Side approach mechanism (SAM)



Approach mechanisms enable contacting via a lateral stroke. Both manual and automatic approach mechanisms are available. Using the automatic, stroke-controlled approach mechanism, the vertical contacting stroke is converted into a horizontal stroke *(see catalogue page 179-184).*

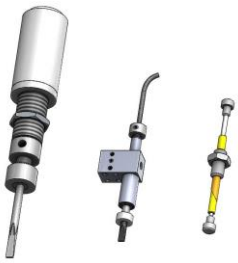
3.3.4 Marking units (ME)



Electrically or pneumatically operated marking units are available to mark PC boards, tested and found to be "good", with a permanent mark. The marking is done in the form of a circular marking or circle point marking by means of a scratching engraver, cutting engraver or milling engraver. The marking units are space-saving *and* are mounted in the exchangeable kit precisely *(see catalogue page 171-178)*.

More information available:	**INFO 2064**, Customising guidelines for marking units

3.3.5 Potentiometer screwing unit/ button activators



Compact manual or automatic screwing units can be used for potentiometer adjustments *(see catalogue page 190-193)*.

3.4 Precision customisation with guide plate

The precision customisation with guide plate is used to contact small test points precisely and reliably.

The test fixture is extended by a guide plate with guide holes, which rests on the moving plate and is firmly mounted there. The guide plate guides the spring-loaded test probes close to the test points to be contacted. This enables precise, reliable contacting of small test points in standard grids up to 1.00 mm (40 mil) with a hitting range of 0.30 mm in diameter (without PCB tolerances).

The precision customisation with guide plate can also be made ESD-compliant for single-sided contacting from below, regardless of the type of test fixture used.

More information available:	**INFO 2018:** Precision customisation with guide plate customising guidelines **INFO 2023:** Precision customisation with counter bore customising guidelines

3.5 INGUN S-Line series

The S-Line product series without receptacles allows the use of test probes with a larger diameter in the same grid size compared to conventional test probes with receptacles. This has the advantage of more mechanically durable probes with a longer service life and improved contacting accuracy.

These advantages are achieved thanks to the concept using the S-Line test probe with a S-Line contact terminal (KT) mounted below. The S-Line contact terminal is pressed into the S-Line contact terminal plate (SKP). The test probe is then fitted onto the contact terminal, thus creating a durable, reliable electrical connection. As a result, the S-Line test probes can be installed in close proximity to each other.

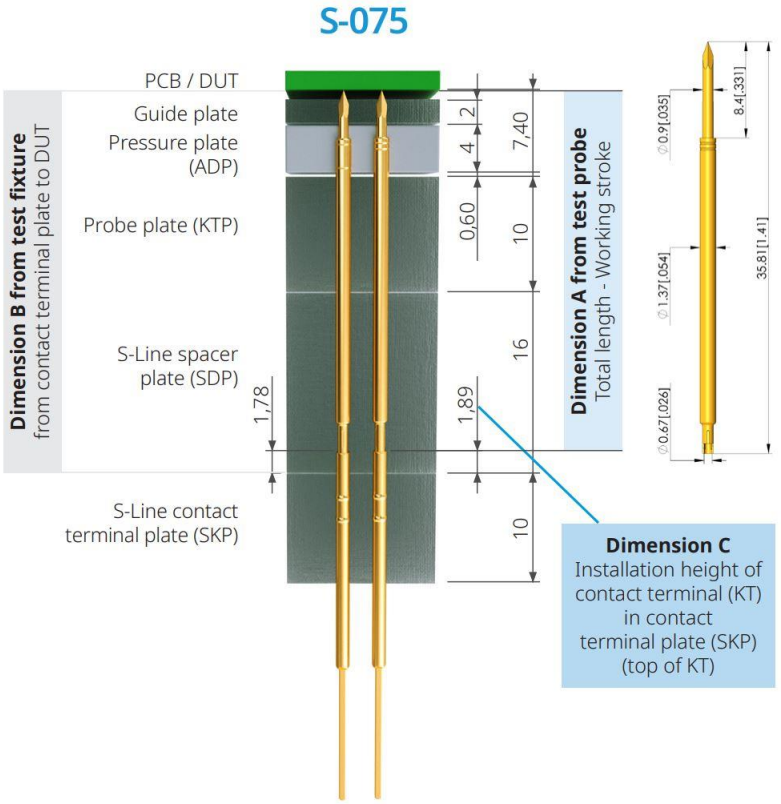


Figure 3: S-Line concept with required plates and dimensions. Example using wire-wrap probes

Various fixture plates are required for the S-Line concept, see figure 3 above. It should be noted that in the S-Line probe plate (KTP), a press fit is created using the contact terminal. All other fixture plates must be drilled so ensure a clearance fit. The required drilling diameters can be found on the of the S-Line test probes product pages. When drilling, ensure that the respective plates are aligned flush with each other using a reference bore.

Installation height

The installation height of the entire S-Line system (test probe and contact terminal) is adjusted by varying the insertion depth of the contact terminal. This is possible thanks to two press rings on the contact terminal, meaning that various test point levels (e.g., pad or pin) can be taken into account.

Tools for installing contact terminals and test probes

Precise, replicable measurements can only be achieved using test probes that have been mounted in the best possible way. A variety of suitable tools for the optimum installation of S-Line test probes and contact terminals are available. You will find a complete overview of the tools in the S-Line brochure.

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More information available:	**INFO 4586**: S-Line customising guidelines

3.5.1 S-Line kits (SBU-...-ATSMAxx) for standard customisation

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
113305	113312	113150	113322	113329	-

The plate sets consist of S-Line spacer plate (SDP), S-Line contact terminal plate (SKP)along with the cylindrical pins, screws and tightening nuts required. These require assembly upon delivery.

3.5.2 S-Line kits (SBU-...-WL-ATSMAxx) for wireless customisation

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
113306	113313	113151	113323	113330	-

Kits for wireless customisation consist of the S-Line spacer plate (SDP), S-Line contact terminal plate (SKP), S-Line guide plate (SFP) and S-Line wireless plate (SWP). The latter is used to stabilise the wireless translation board. The plate sets require assembly, and fittings for installation – cylindrical pins, screws, and tightening nuts - are provided.

Note

⇒ The wireless translation board for the wireless customisation is not included in delivery and must be provided by the customer.

3.6 Rigid pin version

The rigid pin unit is delivered as a kit (KIT), i.e., not assembled. The rigid pin cover is only required for components that are higher than 8 mm or for contacting from above. The rigid pin units and covers shown in the following tables are optimised for the respective exchangeable kit (ATS) size, but they can also be used in larger exchangeable kits.

More information available:	**INFO 1073:** Rigid pin fixture customising guidelines

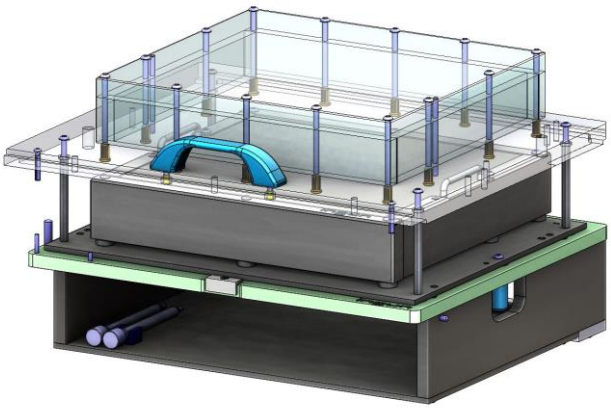


Figure 3: SNK-226-204-ATSMA12

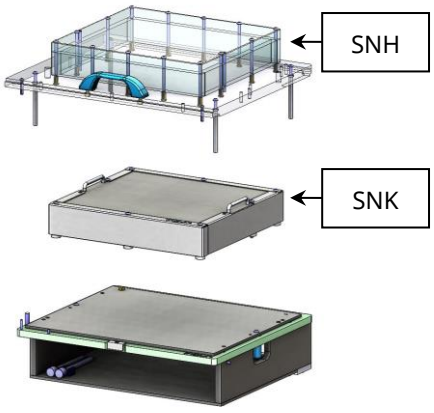


Figure 4: Rigid pin unit (SNK) and rigid pin cover (SNH)

3.6.1 Rigid pin cassette (SNK)

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
109207-KIT	109217-KIT	108791-KIT	109226-KIT	109235-KIT	-

Note for use

⇒ When contacting from above (see section 7.9, page 61) the rigid pin cover listed below is required.

⇒ The use of the lifting units (see section 7.5, page 57) is only possible with the rigid pin cover.

3.6.2 Rigid pin cover (SNH)

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
109244-KIT	109248-KIT	108795-KIT	109252-KIT	109256-KIT	-

Note for use

⇒ Depending on how it is customised, the force of the standard gas pressure spring may not be sufficient for the rigid pin cover. If so, this must be replaced by a stronger gas pressure spring (see section 5.2.14, Pg. 45).

⇒ The stiffener bar for the MA12 (see section 7.2.1, page 55) can also be used for the rigid pin covers SNH-381-274-ATSMA13 and SNH-481-274-ATSMA14.

3.7 Customisation for inline systems

Some manufacturers of inline test systems can use the exchangeable kits for the MA xxxx in their inline test systems as an exchangeable kit. This makes it possible to switch from manual testing to fully automatic inline testing and back again with just one exchangeable kit.

3.7.1 CRS test station

For a CRS online customisation, the CRS-specific ATS can be used.

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
-	-	108812	108813	108814	-

More information available:	**INFO 4365:** ATS MAxx/CRS IPS19 (inline) customising guidelines

3.7.2 KABTEC test station

For a KABTEC inline customisation, the suitable upgrade kit can be combined with a standard ATS with internal interface.

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
-	-	101865+ATS	105630+ATS	105500+ATS	-
		(see section 1.2.1.1, page 8. and 1.2.1.2, page 8)			

More information available:	**INFO 4065:** ATS MAxx/S-x/KABTEC (inline) customising guidelines

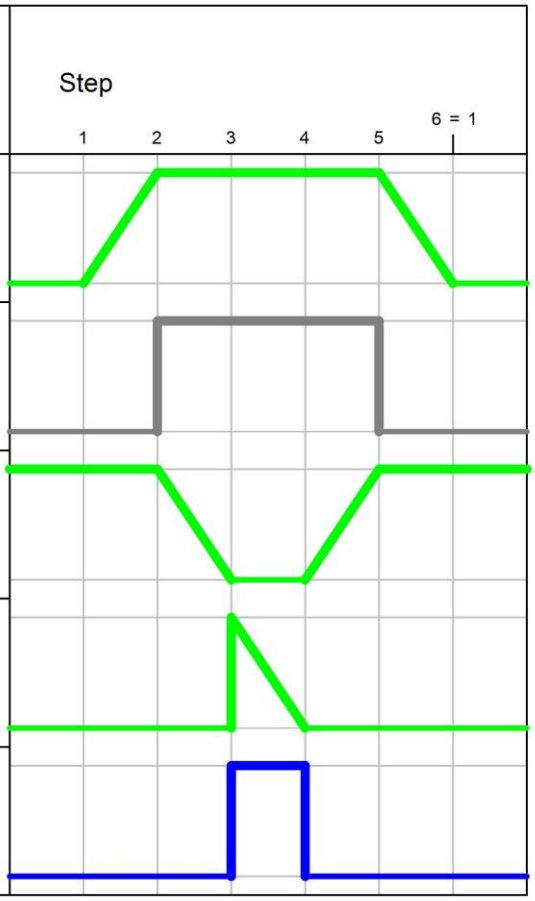
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4 FUNCTIONAL SEQUENCE

The typical test sequence is displayed here using a flow-diagram. The steps carried out by the operator are displayed in green. The UUT (Unit Under Test) detection is part of the ATS customisation; it is not absolutely necessary, but highly recommended.

The functional sequences displayed here are the basis of INGUN product design. These can differ depending on the test application.

Operation	Signal < = from > = to Test Fix...	Status
Place/remove UUT/PCB		present empty
UUT/PCB present (e.g. using SKS = switching probe)	<	active de-active
Open/close Pressure frame		open closed
Start (e.g. using separate push-button		active de-active
Test	<>	active de-active



5 OPTIONAL FUNCTIONAL UNITS

Using the optional functional units, the test fixtures can also be upgraded at a later date by the operators themselves. These units are always delivered with the respective installation instructions describing the installation and, if necessary, the required operating steps. Usually, all the necessary installation fixings are already provided, but machine work requiring respective operational expertise is sometimes required.
In general, the notes for use must be considered because non-optional functional units /additional functional units can be combined and/or other aspects must be considered.

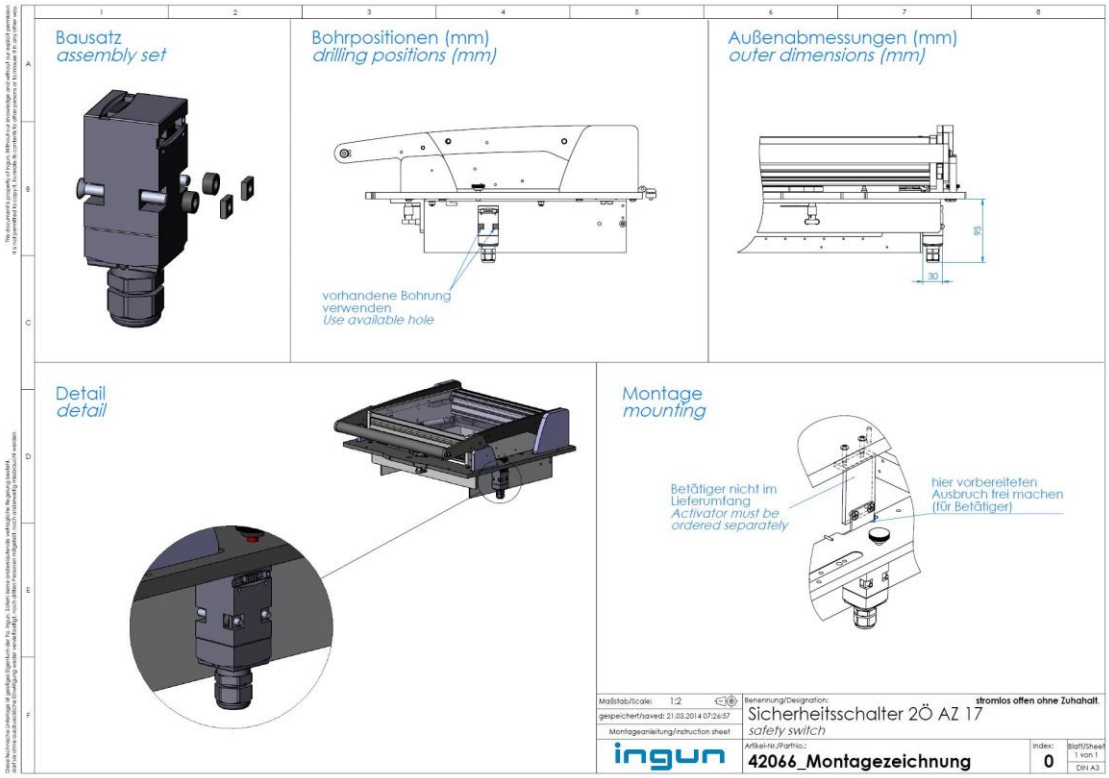
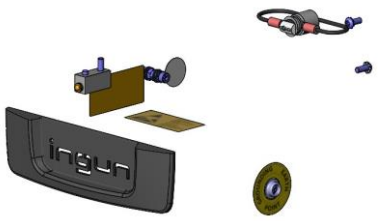


Figure 9: example of installation instructions

5.1 Optional functional units MA xxx

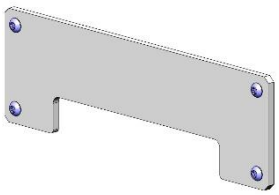
5.1.1.1 FB-ESD-MAxxx ESD customisation

MA 260	MA 350	MA 360
	44979	



5.1.1.2 Rear panel with cut-out for cables

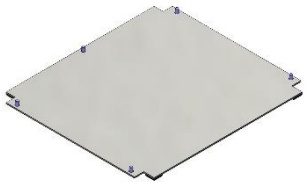
MA 260	MA 350	MA 360
51703	51768	51707



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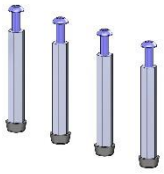
5.1.1.3 *Base plate*

MA 260	MA 350	MA 360
51706	51710	51708



5.1.1.4 *Adjustable feet for applications without housing (pack of 4)*

MA 260	MA 350	MA 360
	51860	



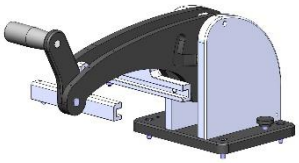
5.1.1.5 *Gas pressure spring to secure open pressure frame plate*

MA 260	MA 350	MA 360
48460	-	-



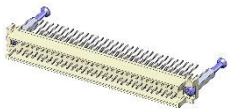
5.1.1.6 *Drive unit*

MA 260	MA 350	MA 360
44120	41570	45668



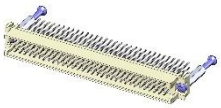
5.1.1.7 *VG male multipoint connector set (64-pole)*

MA 260	MA 350	MA 360
43135 (wire-wrap connection)		



5.1.1.8 *VG male multipoint connector set (96-pole)*

MA 260	MA 350	MA 360
47910 (wire-wrap connection)		



5.2 Optional functions MA xxxx

5.2.1 FB-SLV-MA: Protection conductor wiring and contact protection for hazardous voltages

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
113130	112471	112472	112473	112475	112474	-
ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA11	ATS MA14	ATS MA15
41809	41811	41812	41813	41811	41814	-

When testing with a hazardous voltage (>25V AC and >60V DC) the test fixture must be equipped with protective equipotential bonding, and protection type IP3x according to DIN EN 60529 must be fulfilled. The customising according to the low-voltage directive (NSRL) consists of the safety protection conductor wiring (yellow/green cable) to all relevant parts and the check via insulation resistor at pre-defined places (limit 0.3 Ω). If the protective conductor wiring is used within the framework of the Low Voltage Directive, the max. voltage is 1,000 VAC and 1,500 VDC.

WARNING: Air distance and maximum permissible current: (see section **2.1.2**, page 11)

For proper assembly, see INFO documents:	**112502:** Protective earth wiring and shock-proof protection for dangerous voltages

Necessary additional functional units:

⇒ Safety switch for closed pressure frame (see section **5.2.6**, page 28)

⇒ Actuator for safety switch with and without locking (see section **7.7**, page 59)

WARNING: When customising, care must be taken to ensure that all cables carrying dangerous voltages are as short as possible and, if necessary, also fixed in place. (This will prevent cables from coming into contact with operating elements in the front area of the test fixture in case of possible cable breakage).

Warning: In case of any changes of the protective earth wiring (e.g., exchange of wires or replacement of the cable gland), new measurement of the protective earth resistance is necessary!

5.2.2 FB-ESD-MA: ESD assembly

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
33482				13915	33482	-
ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA11	ATS MA14	ATS MA15
See section **1.2.1.2**, page 8 for part number						-

In case of ESD assembly, the test fixture is equipped with an ESD wiring (black cable) with grounding connection and a connection for an ESD antistatic strap.

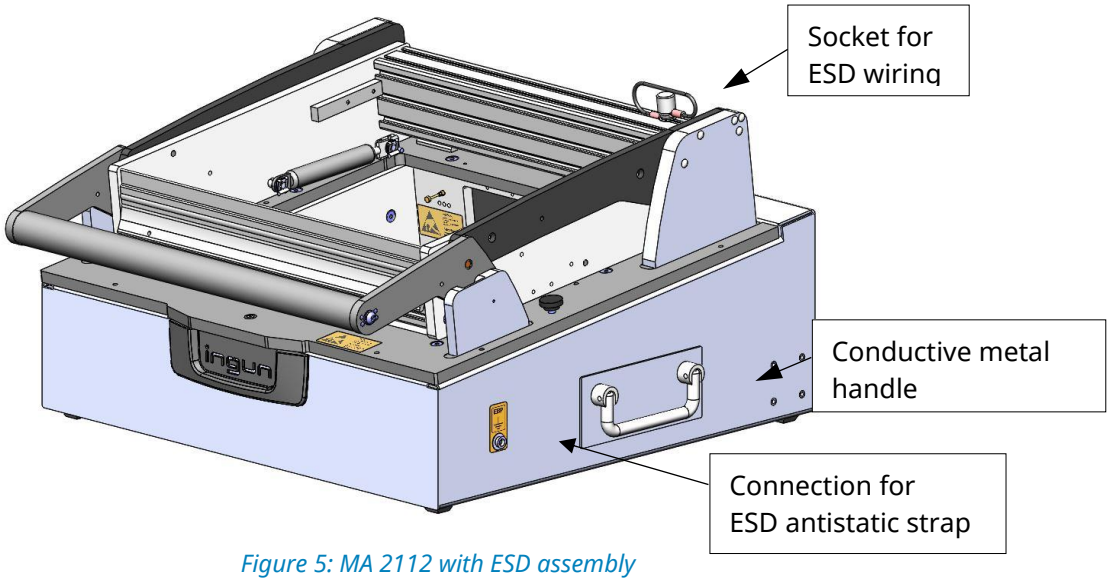


Figure 5: MA 2112 with ESD assembly

Note for use

⇒ The MA 20xx with ESD customisation not equipped with an ESD-coated probe plate as standard. An ESD-coated probe plated is available upon request.

⇒ For ATS and test fixtures with ESD version of the first generation, new ESD discharge cable with ESD press-stud connector can be ordered at INGUN under part number 48215.

⇒ The antistatic wrist strap must not be connected to the bush of the ESD discharge cable.

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5.2.3 FB-ESD-S-MA: ESD assembly and protection conductor wiring

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
43597				113081	43597	-
ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA11	ATS MA14	ATS MA15
See section **1.2.1.2**, page 8 for part number						-

The above mentioned part numbers shall be used only in connection to the part numbers of the protective earthwiring *(see section **5.1**, page 21)*.

For proper assembly, see INFO documents:	**112502:** Protective earth wiring and shock-proof protection for dangerous voltages

5.2.4 FB-2VM-MA: Dual-stage contacting from bottom side (no self-opening)

Dual-stage contacting consists of the first stage for the in-circuit test (ICT) and second stage for the function test (FCT), which is approx. 5 mm above the first stage. Both contacting stages have mechanical limits and are not statically locked.

MA 2x09	MA 2x11	MA 2x12	MA 2x13	MA 2x13T	MA 2x14	MA 2x15
106834						-
-	MA 3x11	MA 3x12	MA 3x13	MA 3x13T	MA 3x14	-
-	106841					-
ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA11	ATS MA14	ATS MA15
48266						-

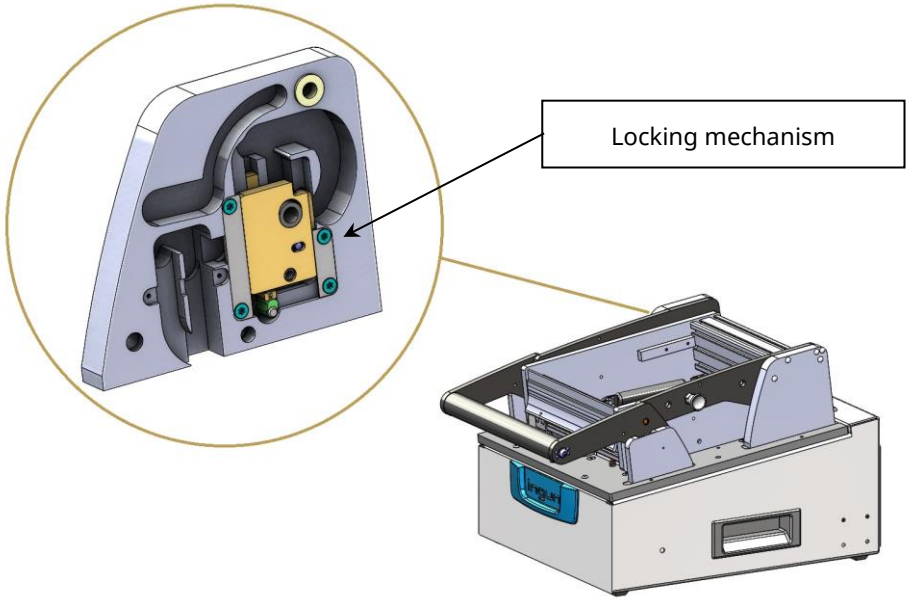
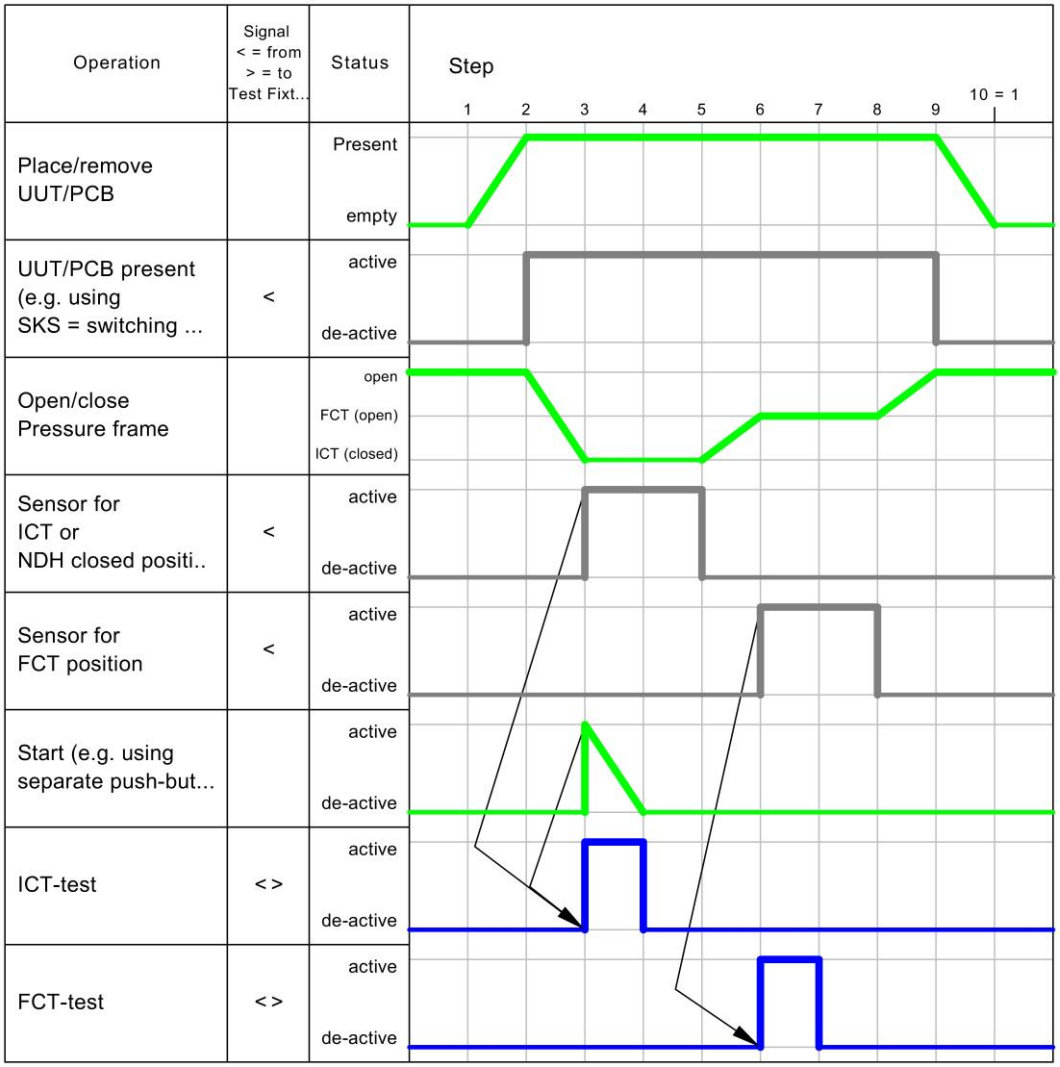


Figure 6: MA 2109 with mechanical dual-stage locking unit

The sequence of this dual-stage contacting is displayed in the following functional diagram:



Note for use

⇒ A check to ensure the pressure frame is closed is necessary when using the dual-stage function (see section **5.2.9.1**, page 40 or **5.2.9.2**, page 41).

⇒ A dual-stage upgrade kit "FB-2SN-ATSMAxx" (part number 48266) is required to cover the higher test probes for FCT with the DUT support.

⇒ When the function is switched on, the fixture can only be opened to the FCT level.

⇒ By pressing the handle lightly, the lock is released without touching the ICT probes again.

⇒ This dual-stage function is exclusively for contacting from the bottom side. (Dual-stage contacting from the top side is possible as a specialised solution in the exchangeable kit)

⇒ Combination with self-opener, *(see section **5.2.5**, page 26)*

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5.2.5 FB-2VM-SO: Dual-stage contacting with self-opener

An electric motor is required to perform tests with a self-opening unit when using the dual-stage function.

MA 2x09	MA 2x11	MA 2x12	MA 2x13	MA 2x13T	MA 2x14	MA 2x15
110515						-
-	MA 3x11	MA 3x12	MA 3x13	MA 3x13T	MA 3x14	-
-	110538					-
ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA11	ATS MA14	ATS MA15
48266						-

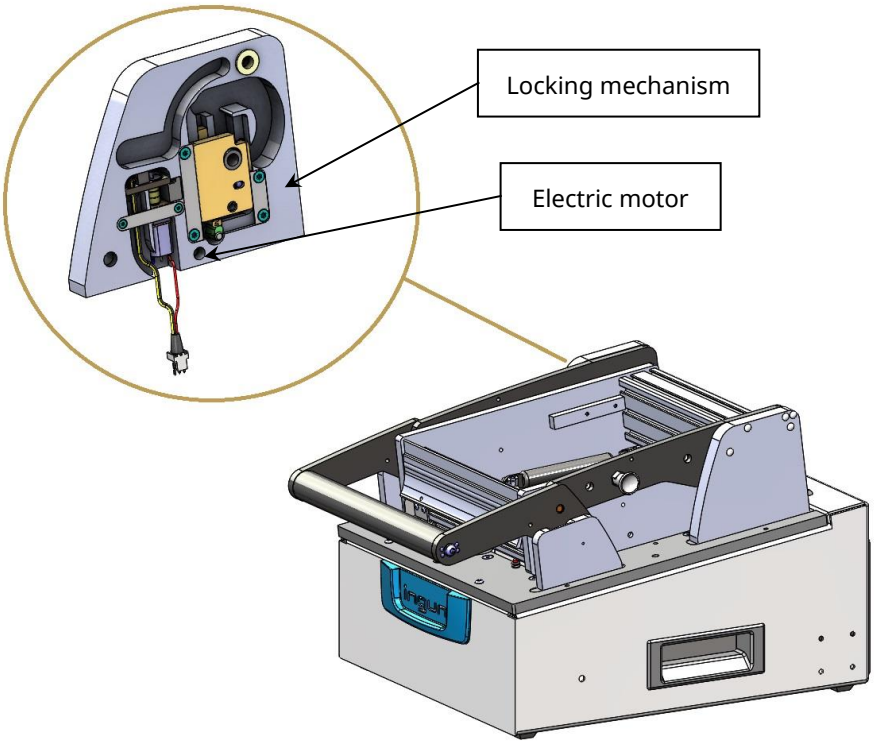
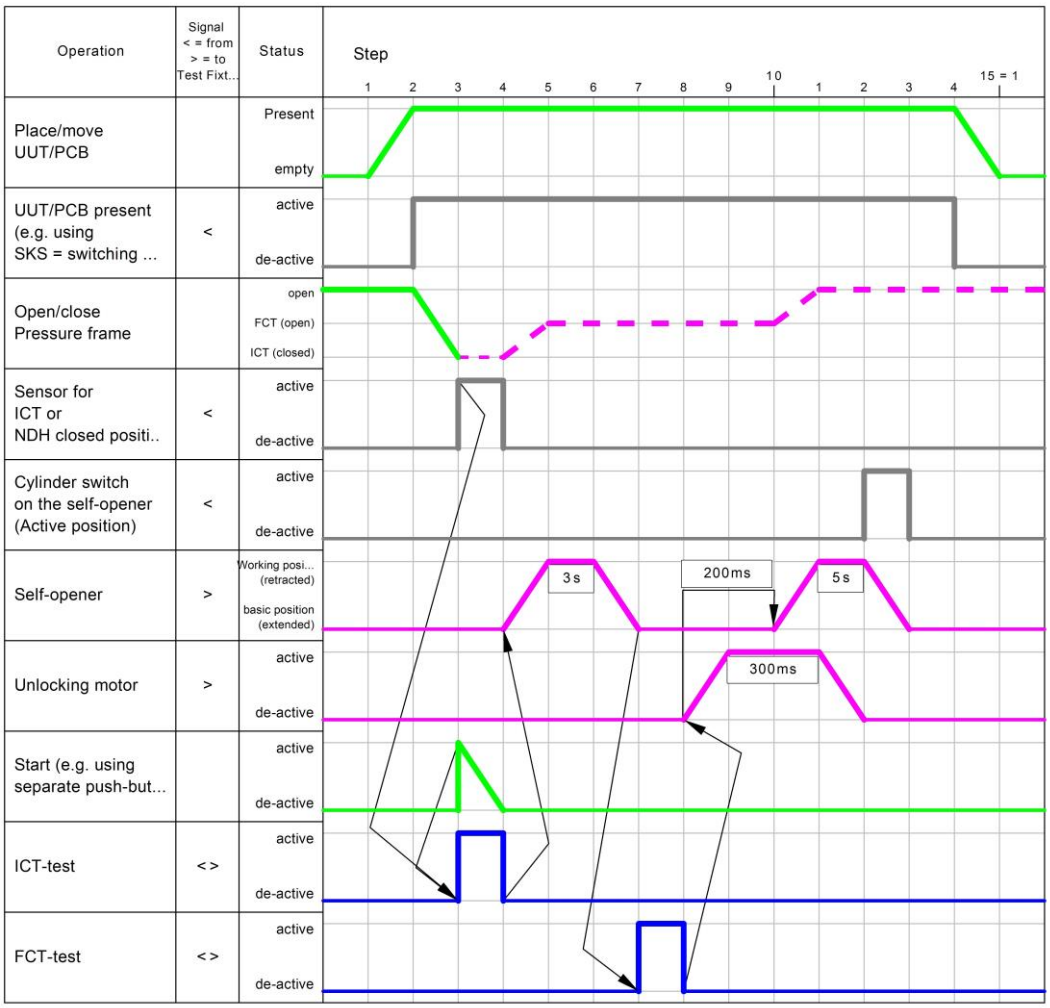


Figure 7: MA 2109 with mechanical dual-stage locking unit with self-opener

The dual-stage contacting process with self-opener is shown in the following function diagram:



Note for use

⇒ A check to ensure the pressure frame is closed is necessary when using the dual-stage function (see section 5.2.9.1, page 40 or 5.2.9.2, page 41).

⇒ The inductive proximity switch (part number 111136) *(see section 9.1.7, page 64)* is required to detect the FCT position.

⇒ A dual-stage upgrade kit "FB-2SN-ATSMAxx" (part number 48266) is required to cover the higher test probes for FCT with the DUT support.

⇒ If necessary, the test fixture can be opened manually only as far as the FCT level, even when the function is switched on. By pressing the handle lightly, the lock is released without touching the ICT probes again.

⇒ This dual-stage function is exclusively for contacting from the bottom side. (Dual-stage contacting from the top side is possible as a specialised solution in the exchangeable kit)

⇒ Combination with self-opener, (see section 5.2.5, page 26)

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5.2.6 Safety switch for closed pressure frame

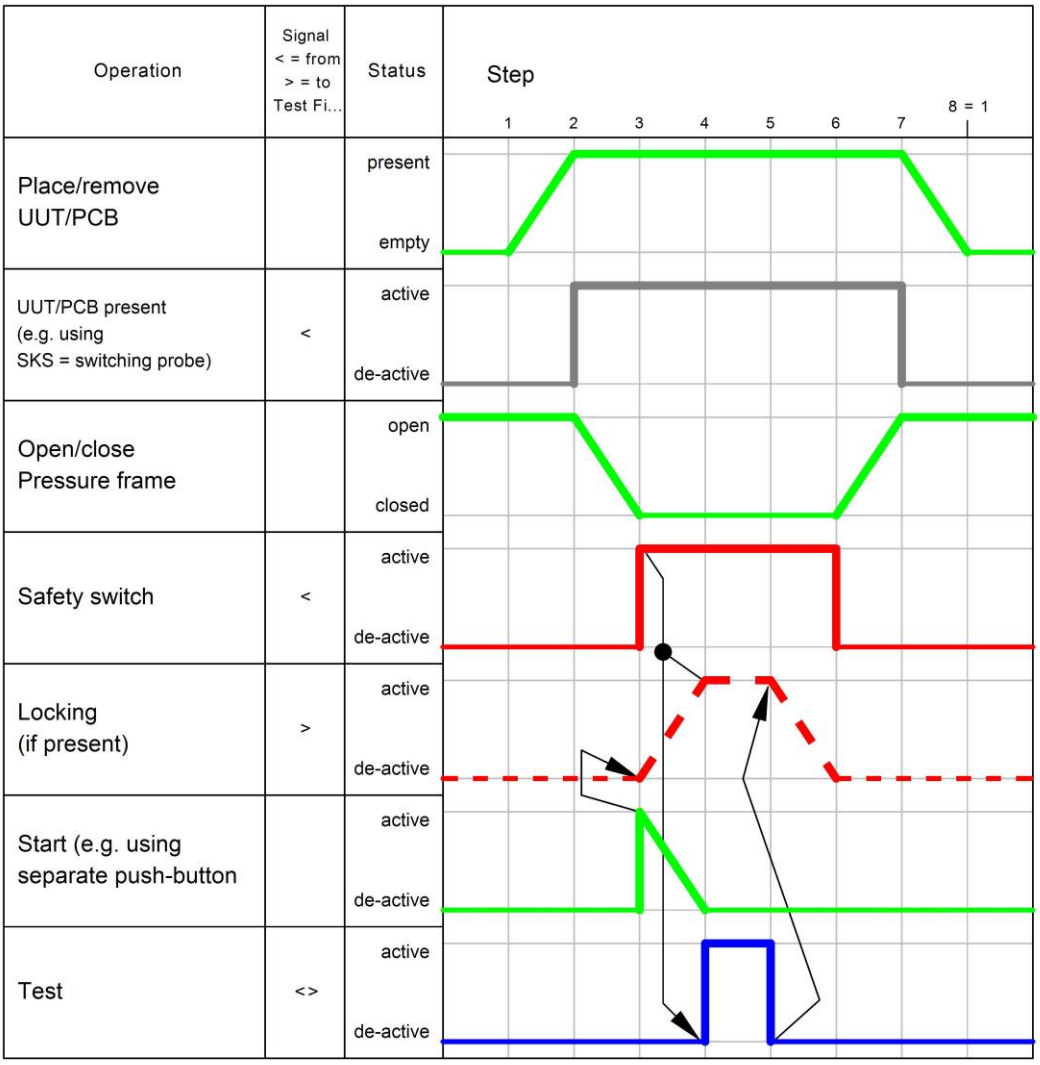
When testing in the low-voltage range (i.e., greater than 50V AC or 75V DC) the closed pressure frame unit is a prerequisite that the testing voltage can be applied. The closed pressure frame unit therefore has a safety function and must be checked with an authorised safety switch. The processing of the signal of the safety switch must fulfil the demands of DIN EN ISO 13849 – “Safety-related parts of the control unit”.

Notes for use

⇒ The solenoid interlock in the safety switch cannot be used as a locking unit to protect the test function (due to the undefined closing point, the test probes could lose contact, for example).

⇒ The magnetic safety switch cannot be used with the dual-stage functions.

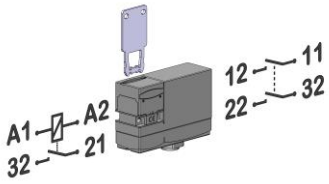
INGUN recommends the integration of the safety switch in accordance with the following functional sequence:



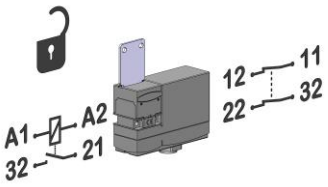
5.2.6.1 FB-SIS-ZSO-MA: Safety switch with solenoid interlock NO (currentless; open)

Application To safely lock test fixtures: power to lock!

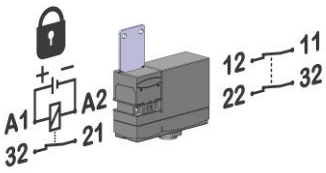
MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
36210				36210 (2x)	36210	
ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA11	ATS MA14	ATS MA15
100414	36455					
	47740 for dual-stage contacting *(see section 5.2.4, page 24)*					-



Actuator not inserted

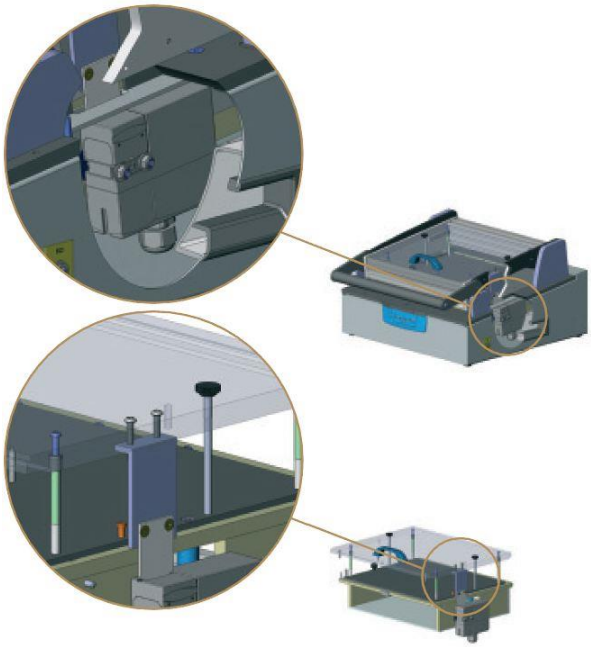


Actuator inserted



Apply power to lock

Technical details:



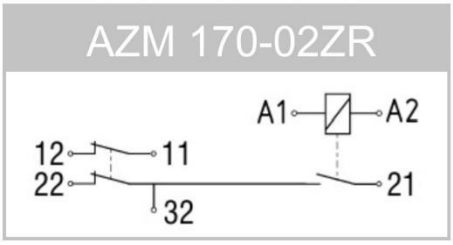
Safety classification:
- Standards EN ISO 13849-1
- Performance Level, up to c
- Category 1
- B_{10d} opener (NC): 2,000,000
- Mission time 20 Year(s)

Safety classification with 2-channel use and with suitable logic unit - Fault exclusion:

Can be used when fault exclusion for dangerous damage to the 1- channel mechanism is permissible and sufficient protection against manipulation is guaranteed.
- Performance Level, up to d
- Category 3
- Mission time 20 Year(s)

Mechanical data
- Manual release present: Yes
- Press-on force: 30 N
- Forced opening force: 8.5 N
- Forced opening path: 11 mm
- Holding force F_{max}: 1.000 N
- Max. activating speed: 2 m/s
- Temperature range: -25 to +60 °C
- Degree of protection: IP67

Electrical data
- Working current principle: Yes
  The test fixture can be opened without a power supply.
- Design of switching element: 2x Opener (NC)
- Switching principle: Contact elements with slow-action contact
- Number of safety contacts: 2 pc.
- Rated control supply voltage U_s: 24 VAC/DC



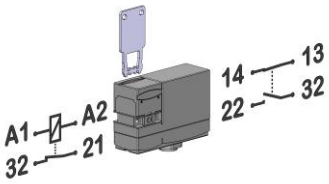
- Power input: max. 12 W
- Rated surge voltage resistance Uimp: 4kV
- Rated insulation voltage Ui: 250 V
- Thermal continuous current Ithe: 6 A
- Utilisation category: AC-15: 230 V /4 A, DC-13: 24 V / 4 A
- Shorts protection: 6 A gG D safety

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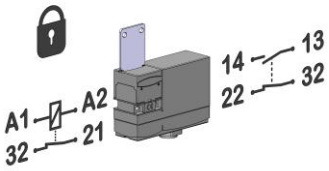
5.2.6.2 FB-SIS-ZSG-MA: Safety switch with solenoid interlock NC (currentless; closed)

Application To safely lock test fixtures: power to unlock!

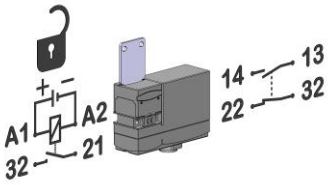
MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
46020				46020 (2x)	46020	
ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA11	ATS MA14	ATS MA15
100414	36455					
	47740 for dual-stage contacting *(see section 5.2.4, page 24)*					-



Actuator not inserted



Actuator inserted



Apply power to unlock

Technical details:

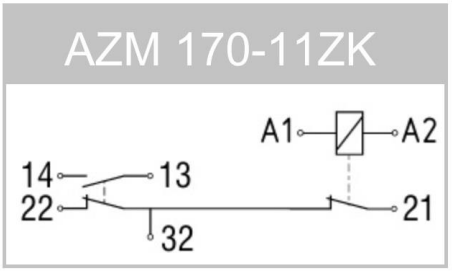
Safety classification:
- Standards EN ISO 13849-1
- Performance Level, up to c
- Category 1
- B_{10d} opener (NC): 2,000,000
- Mission time 20 Year(s)

Safety classification with 2-channel use and with suitable logic unit - Fault exclusion:

Can be used when fault exclusion for dangerous damage to the 1- channel mechanism is permissible and sufficient protection against manipulation is guaranteed.
- Performance Level, up to d
- Category 3
- Mission time 20 Year(s)

Mechanical data
- Manual release present: Yes
- Press-on force: 5 N
- Forced opening force: 8.5 N
- Forced opening path: 11 mm
- Holding force F_{max}: 1.000 N
- Max. activating speed: 2 m/s
- Temperature range: -25 to +60 °C
- Degree of protection: IP67

Electrical data
- Power to unlock: yes **The test fixture cannot be opened without a power supply.**
- Design of switching element: Closer (NO), Opener (NC)
- Switching principle slow action, positive break NC contact
- Number of auxiliary contacts: 1 pc.
- Number of safety contacts: 1 pc.
- Rated control supply voltage U_s: 24 VAC/DC
- Power input: max.: 12 W
- Rated surge voltage resistance U_{imp}: 4kV
- Rated insulation voltage U_i: 250 V
- Thermal continuous current I_{the}: 6 A
- Utilisation category: AC-15: 230 V /4 A
  DC-13: 24 V / 2,5 A



Note for use

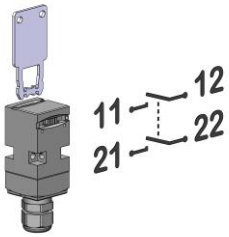
⇒ The test fixture can only be opened when connected to power supply.

⇒ The triangular key, part number 33647, can also be used to unlock the fixture manually.

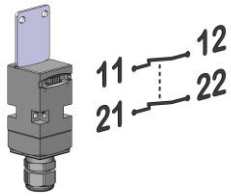
5.2.6.3 FB-SIS-MA: Safety switch without solenoid interlock

Application To safely lock test fixtures without solenoid interlock!

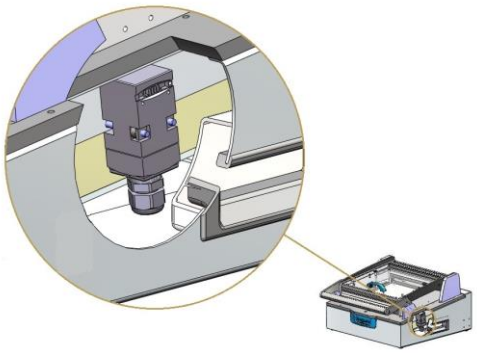
MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
42066				42066 (2x)	42066	
ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA11	ATS MA14	ATS MA15
100414	36455					
	47740 for dual-stage contacting *(see section 5.2.4, page 24)*					-



Actuator not inserted



Actuator inserted



Technical details:

Safety classification:

- Standards EN ISO 13849-1
- Performance Level, up to c
- Category 1
- B_{10d} opener (NC): 2,000,000
- Mission time 20 Year(s)

Safety classification with 2-channel use and with suitable logic unit - Fault exclusion:

Can be used when fault exclusion for dangerous damage to the 1-channel mechanism is permissible and sufficient protection against manipulation is guaranteed.

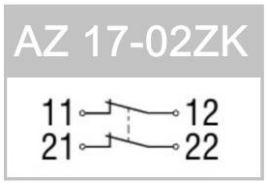
- Performance Level, up to d
- Category 3
- Mission time 20 Year(s)

Mechanical data

- Latching force: 5 N
- Positive break force per NC contact, minimum: 17 N
- Positive break travel: 11 mm
- Temperature range: -25 to +80 °C
- Degree of protection: IP67

Electrical data

- Switching element: Opener (NC)
- Switching principle: slow action, positive break NC contact
- Rated surge voltage resistance U_{imp}: 4kV
- Rated insulation voltage U_i: 250 V
- Thermal test current I_{the}: 10 A
- Utilisation category: AC-15: 230 V /4 A
  DC-13: 24 V / 2,5 A



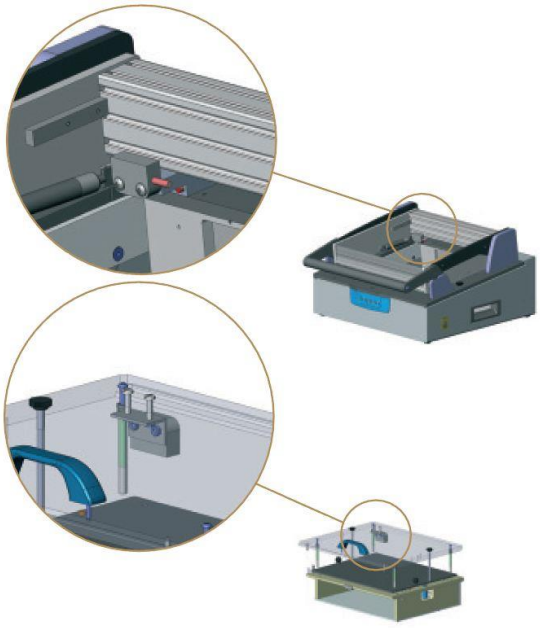
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5.2.6.4 FB-SIS-BM-MA: Magnetic safety switch

Application To safely lock test fixtures without solenoid interlock.

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
41560		41558	41556	41560 (2x)	41553	-
ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA11	ATS MA14	ATS MA15
41552						-

Technical details:



Safety aspects

- Standards: EN ISO 13849-1
- B_{10d} Opener/Closer (NC/NO): 25.000.000
- Duration of usage: 20 years

Safety classification with Signal processing part no. 46084

- Performance Level up to e
- Category, Stop 4
- Diagnostic Coverage (DC) Level 0 ≥ 99 %

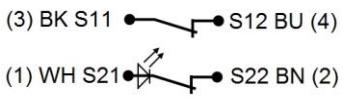
Environmental conditions

- Assured switching distance "ON" S_{ao} 5 mm
- Assured switching distance "OFF" S_{ar} 15 mm
- Temperature range: -25 to +70 °C
- Protection type: IP67

Electrical Data

- Rated insulation voltage U_i: 50 VAC
- Rated surge voltage resistance U_{imp}: 0,8 kV
- Required rated short-circuit current: 100 A
- Switching frequency: max. 5 Hz
- Switching voltage: max. 75 VDC
- Switching current: max. 400 mA
- Switching power: max. 10 VA

Connection



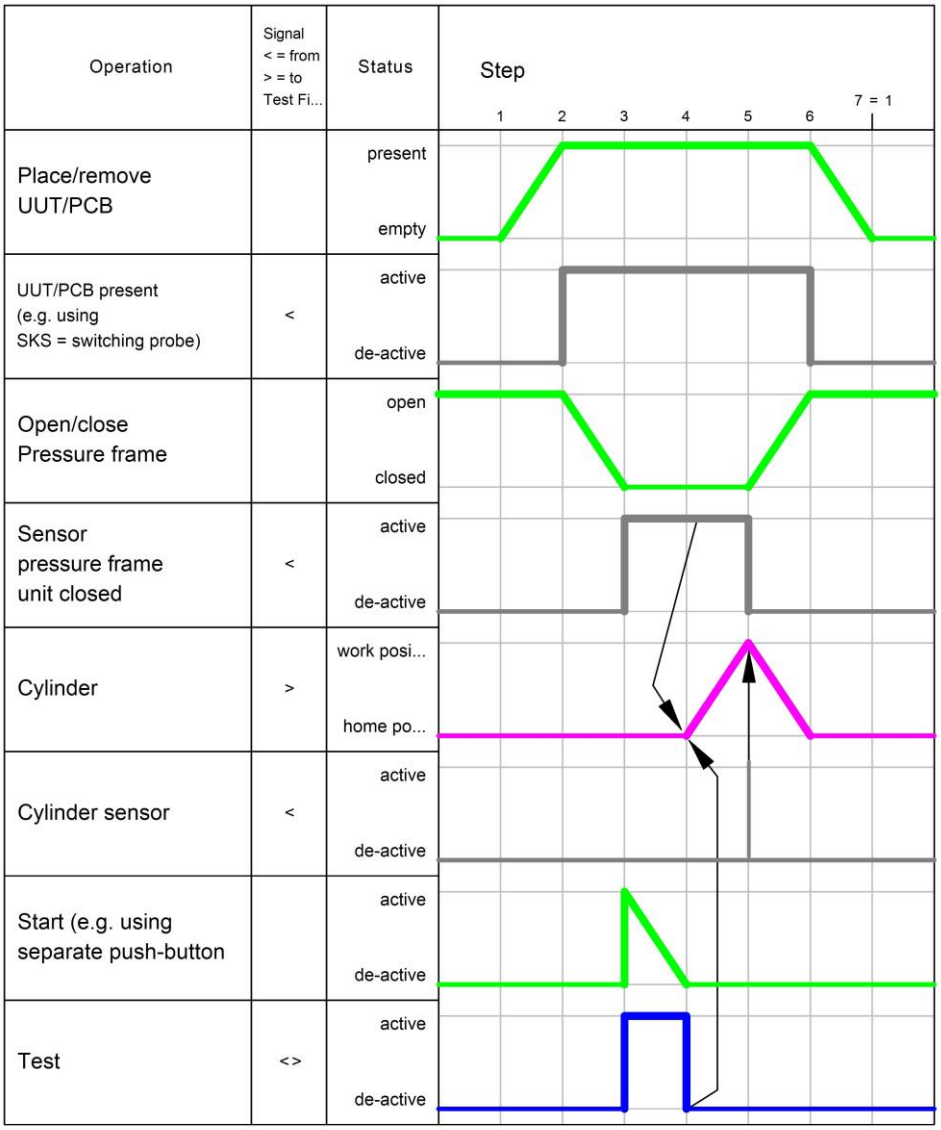
Note for use

⇒ For safety circuit, an evaluation unit for magnetic safety switch (e.g., part no. 46084) is necessary.

⇒ Not suitable for dual-stage function.

5.2.7 Self-opening units

Self-opening units are used to open manual test fixtures automatically and independently. The self-opener mechanic is mounted at the inner side of the test fixture and activated pneumatically. A hydraulic brake cylinder is used to reduce the opening speed, especially when customised with high forces (this brake cylinder is not included in delivery MA 2x09). A MA-control unit, developed and designed by INGUN is offered to control the self-opener function (*see section **5.2.23**, page 48*).



Notes for use

⇒ The self-opening function requires a detection test for the locked position. *(see section **5.2.9.3** page 41)* (If the cylinder is activated and the locked position has not been achieved, the cylinder may not reach its end position due to a swivelling interfering contour, which may result in the signal not reaching the cylinder's end position switch.)

⇒ When the pressure frame (NDH) locking unit is closed, a conflict of functions could occur. For this combination, care should be taken to ensure that self-opener is only activated when the pressure frame (NDH) locking unit is open!

⇒ See section **5.2.5**, page 26 for combination with dual-stage contacting.

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5.2.7.1 FB-SOP-MA: Pneumatic self-opening unit

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
42701	42700			42700 (2)	42700	

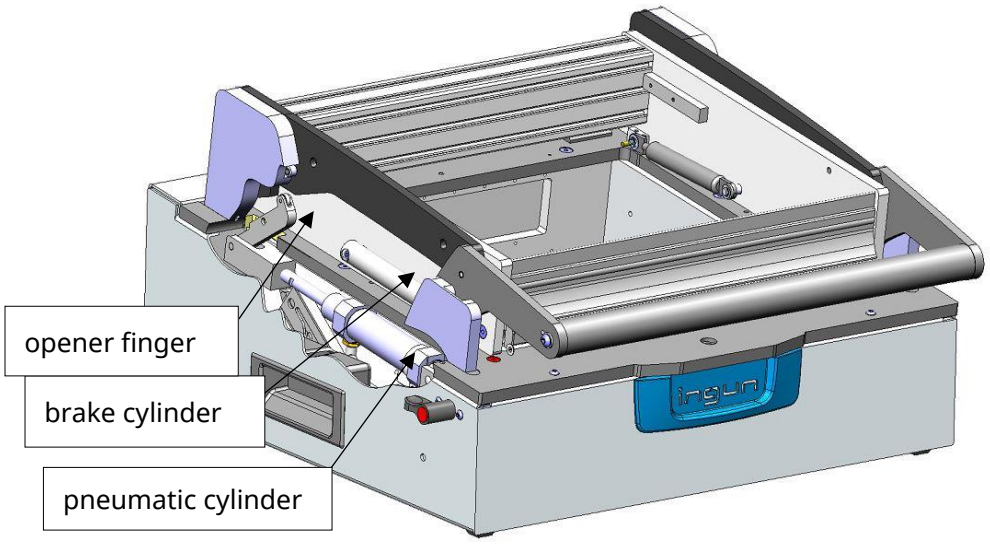


Figure 10: Sectional view of self-opener MA 2112 with pneumatic drive unit

Specification of the components used:

⇒ Brake cylinder D-040-12-040-123 (part number 51863) (see section **9.1.19**, page 67)

⇒ Pneumatic cylinder 25-50 (part number 39203**)** (see section **9.1.15**, page 66)

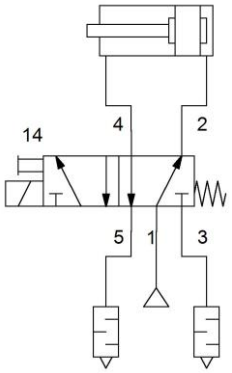
Specification of optional components (not included in delivery):

⇒ Valve assembly 5/2-way (part number 42702**)** (see section **9.1.11**, page 65)

⇒ Compressed air combination (part number 14241**)** (see section **9.1.18**, page 49)

⇒ Valve mounting part (part number 57022) (see section **9.1.25**, page 68)

Pneumatic plan



5.2.7.2 FB-SOE-MA: Electrical self-opening unit

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
-	45220			45220 (2x)	-	-

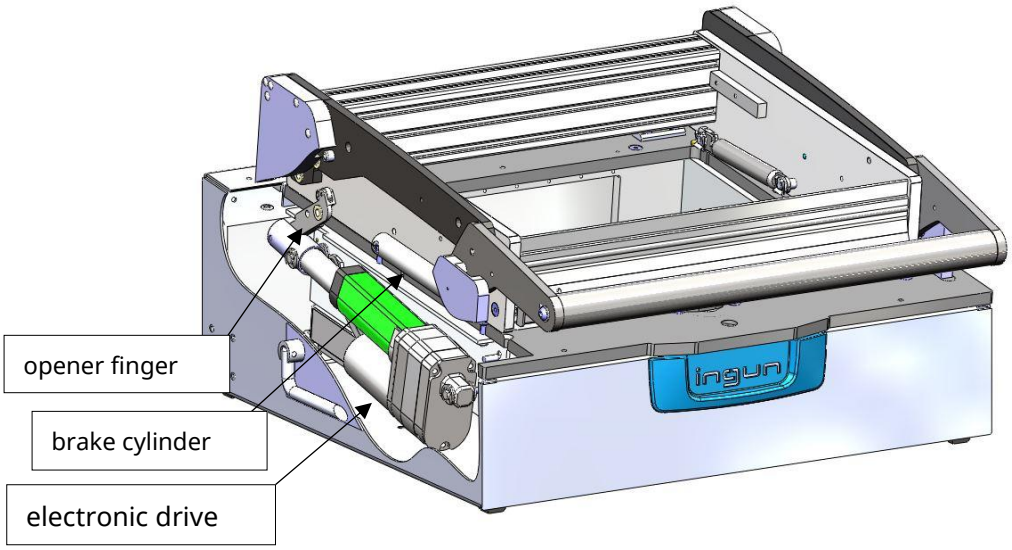


Figure 11: Sectional view of self-opener MA 2112 with electronic drive unit

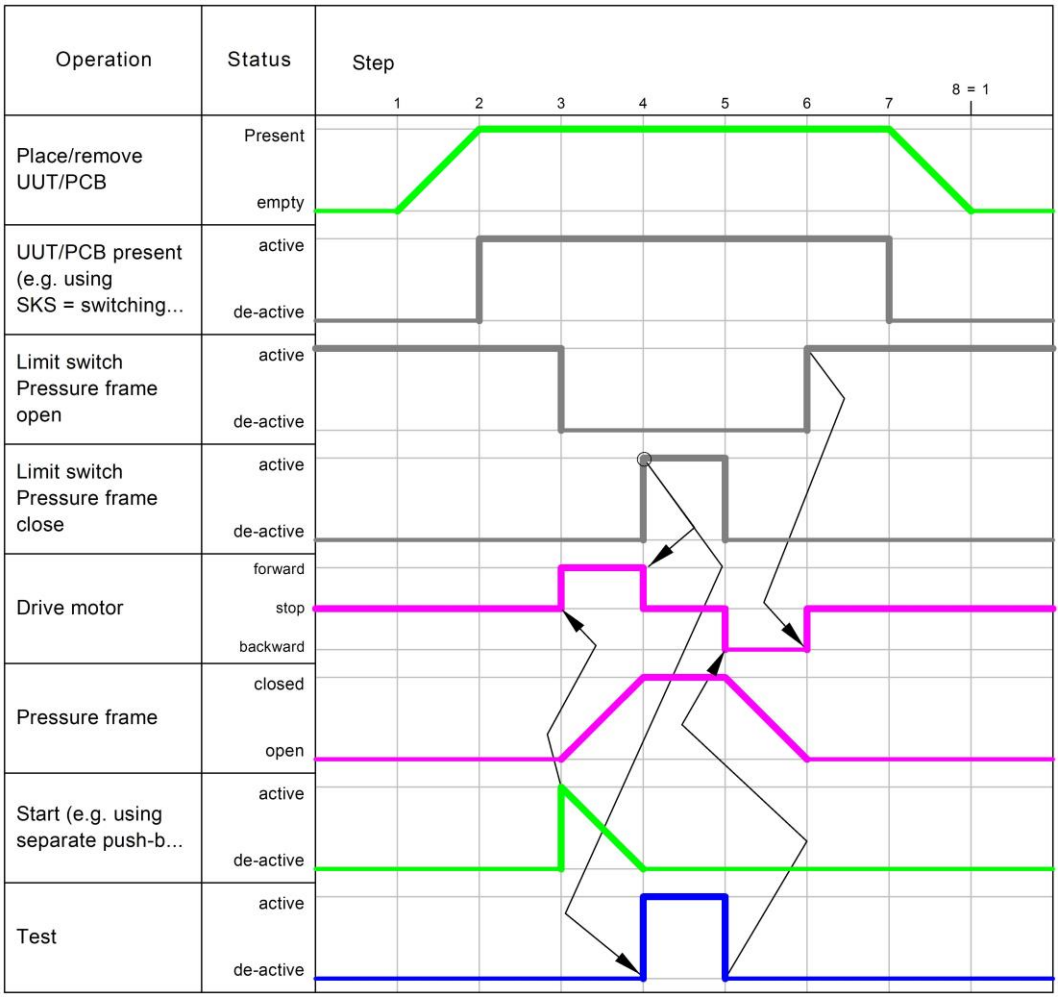
Note for use

⇒ The electric self-opening unit may not be used for customisations which require gas pressure springs with more than 400 N, therefore the self-opener can be used with standard gas pressure springs (400 N) in MA 2x13 fixtures and with gas pressure springs up to 400 N in MA xx11/12 fixtures (e.g., MA 2111 with 400 N for ATS MA11/HF).

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5.2.8 Automatic opener/closer

The automatic opener/closer provides an electric drive unit that enables manual test fixtures to open and close automatically. It is supplied without a control unit or operating panel.





Caution Risk of piercing or puncture injury!

Mechanical hazard when the pressure frame closes and opens automatically! (this is only possible with the functional unit FB-OSA-E-MAxxxx)

- ☞ The test fixture may only be operated in a safe environment that is not accessible to operators or with the functional unit for operational safety (FB-SIS-OSA-MAxxxx).
- ☞ Access to the rear of the test fixture must be restricted to ensure accidental access to the hazard area is impossible.
- ☞ When using the functional unit for operational safety, the switch-off function of the terminal strip must be checked daily.
- ☞ A third-party control unit must include all safety functions according to the INGUN reference design for the control.

Control unit for automatic opener/closer	• **116924**, Electronic control unit (FB-STE-OSA-E – Chap. 5.2.8.3) • **INFO 4594:** Reference design for the control unit

5.2.8.1 FB-OSA-E-MA: Electric automatic opener/closer

MA 2x09 114503	MA 2x11	MA 2x12 113401	MA 2x13 114263	MA 2x13T -	MA 2x14 114263	MA 2x15 -
- -	MA 3x11 -	MA 3x12 -	MA 3x13 -	MA 3x13T -	MA 3x14 -	- -

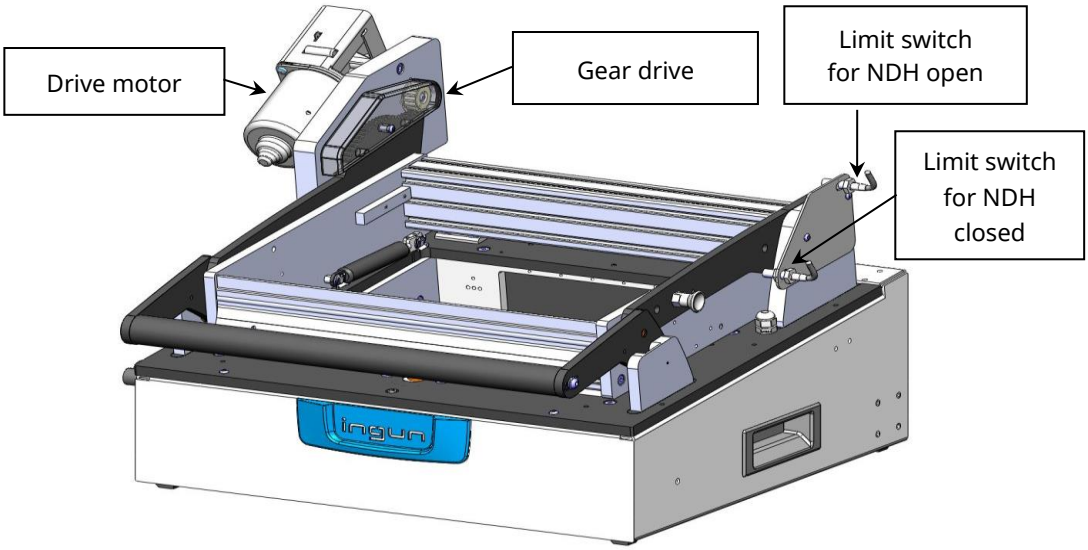


Figure 8: Test fixture with automatic opener/closer

For proper assembly, see INFO documents:	**INFO 4595**: Assembly Instructions automatic opener/closer

Notes for use

⇒ Exceeding the 12-volt supply voltage of the DC gearmotor increases the risk of injury from crushing or shearing and reduces the service life of the test fixture.

⇒ The lack of a short-circuit brake leads to a forceful approach to the end positions. Furthermore, in the event of an emergency stop, the stopping distance is extended, which increases the risk of injury.

⇒ The test fixture may only be operated without a safety switch (FB-SIS-OSA-MA) if suitable protective housings prevent access to any hazardous points for operators.

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5.2.8.2 FB-SIS-OSA-MA: Safety switch

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
114509	114316	113450	114287	-	114826	-

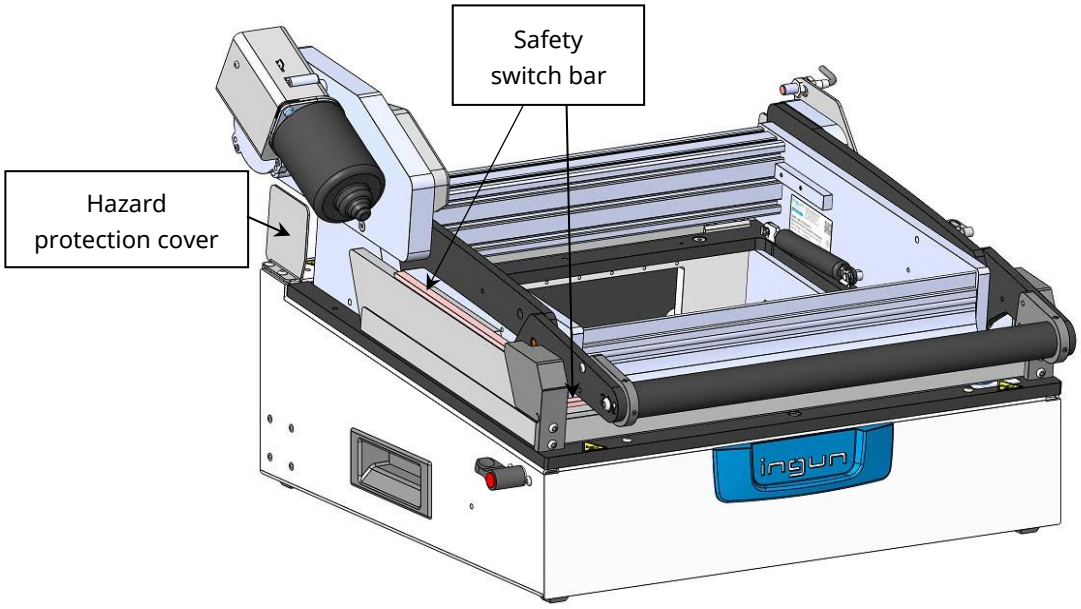


Figure 9: Test fixture with automatic opener/closer and safety switch

For proper assembly, see INFO documents:	**INFO 4596**: Assembly Instructions safety switch

Control unit for automatic opener/closer	• **116924**, Electronic control unit (FB-STE-OSA-E – Chap. 5.2.8.3) • **INFO 4594**: Reference design for the control unit

5.2.8.3 *FB-STE-OSA-E: Electronic control unit*

The electronic control unit is used to control and regulate the opening and closing operations of the automatic opener/closer.

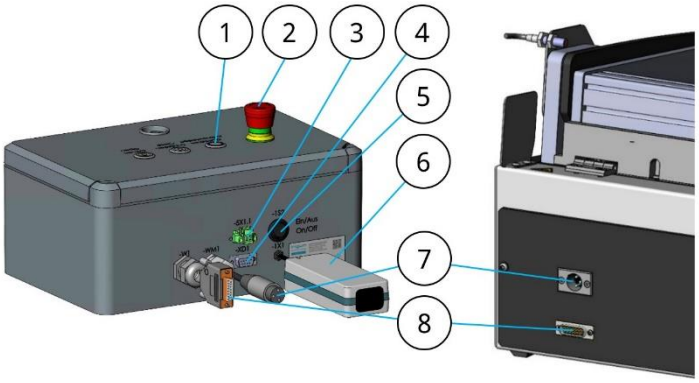
MA 2x09	MA 2x11	MA 2x12	MA 2x13	MA 2x13T	MA 2x14	MA 2x15
116924				-	116924	-



WARNING RISK OF PIERCING OR PUNCTURE INJURY!

WARNING LETHAL ELECTRIC SHOCK!

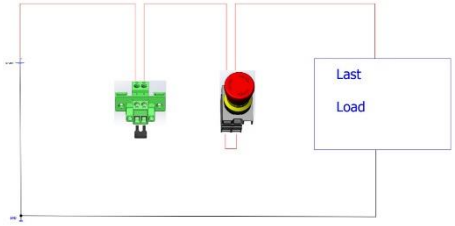
- The electronic control unit safeguards against the mechanical hazards associated with the automatic opening and closing mechanism (PL b).
- Additional safety measures are required when operating the test fixture without a pressure frame plate or when it is connected to hazardous electrical voltage.
- Connecting the electronic control unit to a test fixture requires that a CE conformity assessment procedure be carried out in accordance with the Machinery Directive.



1. Acknowledge button: Activates control; button lights up
2. Emergency stop: Immediate stop; acknowledge button light up
3. Connection 2nd emergency stop
4. In/Outputs (Sub-D 9-pol.)
5. Toggle switch: Control on; button lights up
6. Power supply 12 VDC
7. Motor connection
8. Control connection

Connection for 2nd emergency stop

- 2 normally opener (2 channel)
- 12 VDC / 6 A



In/Outputs (Sub-D 9-pol.):

- Pin1: Emergency stop active (DO)
- Pin2: Busy (DO)
- Pin3: Error (DO)
- Pin4: Limit switch S7 (DO)
- Pin5: Limit switch S8 (DO)
- Pin6: Acknowledge (DI)
- Pin7: Close (DI)
- Pin8: Open (DI)
- Pin9: External GND/0V (24VDC circle)

Notes for use

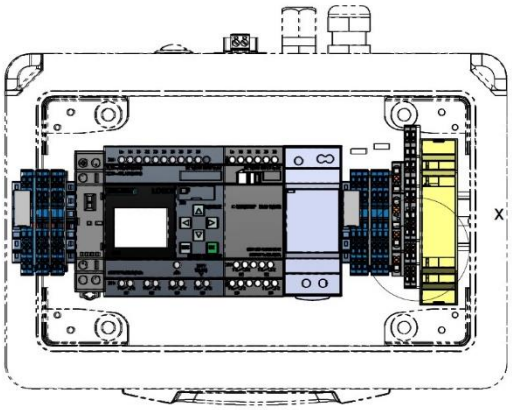
⇒ Für countries with a 110 V mains voltage, a different power supply (12 VDC) is required.

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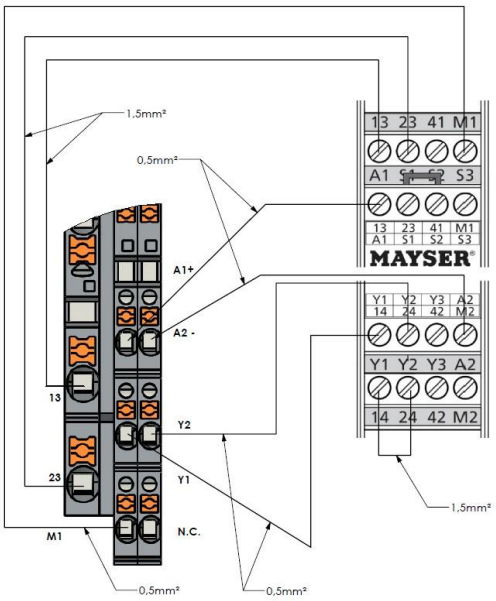
Installation and wiring of the Mayser control unit

- ☞ Required only in conjunction with the safety strip FB-SIS-OSA-MA
- ☞ The Mayser control unit is a component of the safety switch FB-SIS-OSA-MA (Chap. 5.2.8.2)

Mayser control unit



Wiring



Operating principle of the safety switch FB-SIS-OSA-MA

⇒ Activated during opening: Immediate stop; the acknowledge button lights up

⇒ Activated during closing: Closing is interrupted, test fixture opens a short distance; the acknowledge button lights up

5.2.9 Closed pressure frame unit detection

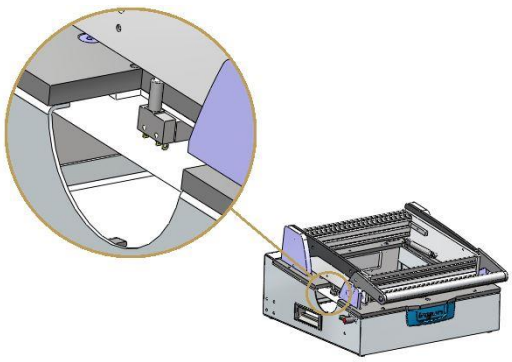
The detection to ensure the pressure frame unit is closed is normally used for control purposes (e.g., to start test).

5.2.9.1 FB-ABF-G-S-MA: Check with stroke switch

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
33840				33840 (2x)	33840	-

Specification of the components used:

⇒ Stroke switch (part number 20202**)**
*(see section **9.1.1,** page 63)*



Note for use:

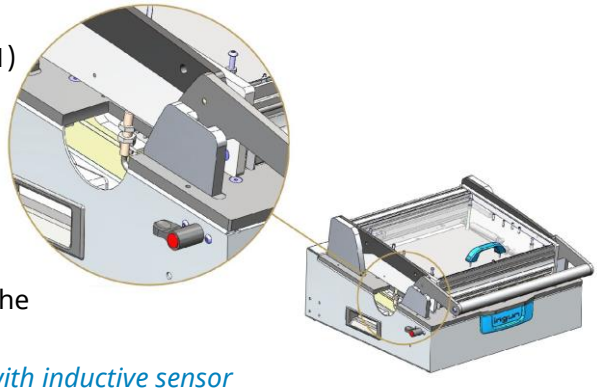
⇒ The closed position of the pressure frame cannot be detected in the FCT position of the dual-step function.

5.2.9.2 *FB-ABF-G-I-MA: Stroke position detection with inductive sensor*

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
37550				37550 (2x)	37550	-

Specification of the components used:

⇒ Inductive sensor M8x1 (part number 33831) (see section **9.1.3**, page 63)



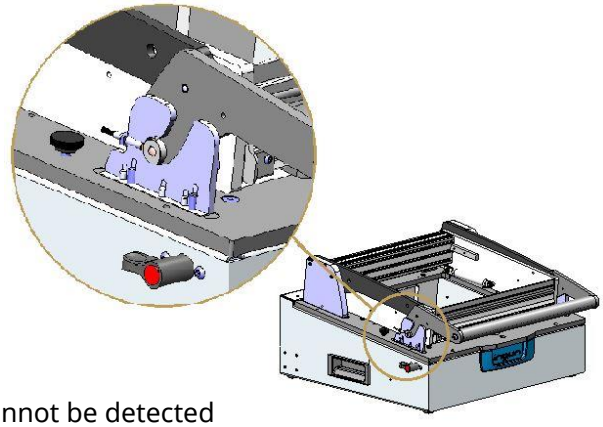
Note for use:

⇒ The closed position of the pressure frame cannot be detected in the FCT position of the dual-step function.

5.2.9.3 *FB-ABF-V-I-MA: Locking position detection with inductive sensor*

MA 2x09	MA 2x11	MA 2x12	MA 2x13	MA 2x13T	MA 2x14	MA 2x15
43625				43625 (2x)	43625	
-	MA xx11	MA xx12	MA xx13	MA 3213T	MA 3214	-
-	46745			46745 (2x)	46745	-

The signal of this check can be used for the start of the test. This sensor is not suitable for monitoring the closed position throughout the entire test cycle.



Specification of the components used:

⇒ Inductive sensor (part number 44833**)**
*(see section **9.1.6**, page 64)*

Note for use:

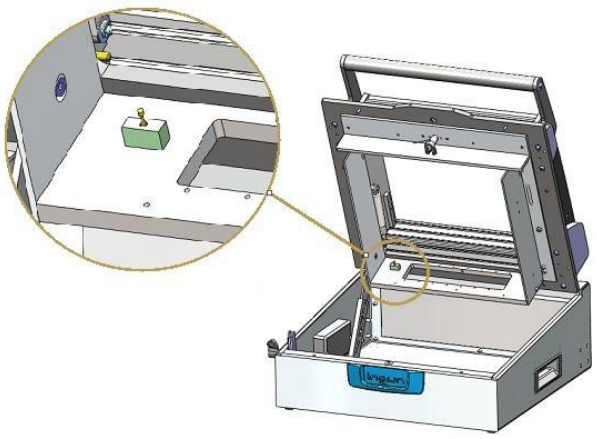
⇒ The closed position of the pressure frame cannot be detected in the FCT position of the dual-step function.

5.2.10 FB-ABF-V-SKS-MA: Locked ATS detection

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
43246				43246 (2x)	43246	

Specification of the components used:

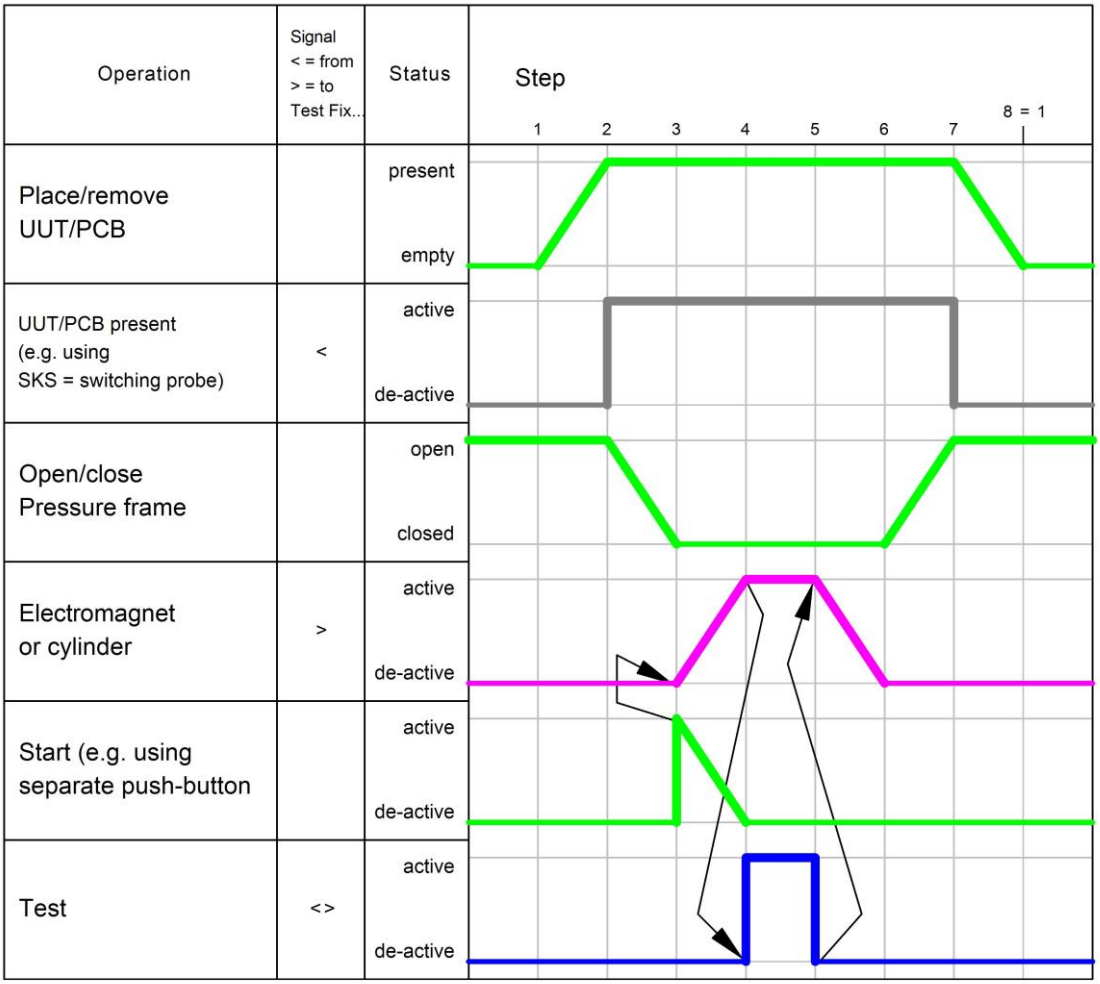
⇒ Switching probe:
SKS-415 002 300 A 1402 E



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5.2.11 Locking unit for closed pressure frame

The locking unit for the closed pressure frame is used when testing must not be interrupted for any reason, or when hazardous voltage could still be present, even after testing. Typically, the functionality is as follows:



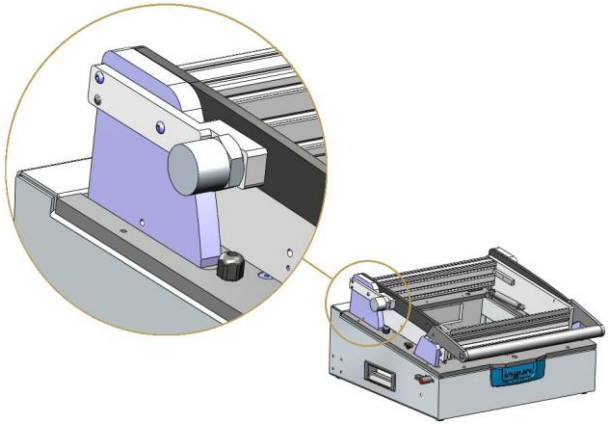
Note for use:
For 2-stage contacting, we recommend fitting the latch on the left and right so that one can be used for ICT and the other for FCT.

5.2.11.1 FB-VER-G-ESG-MA: Stroke magnet NC (currentless; closed)

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
32665				32665 (2x)	32665	

Specification of the components used:

⇒ Stroke magnet NC (currentless; closed) (part number 28194**)**
*(see section **9.1.8**, page 64)*



Note for use

⇒ With this locking unit the test fixture cannot be opened without current.

⇒ When using the currentless locking unit, the electromagnet must be switched in active mode (NC). When used for a long

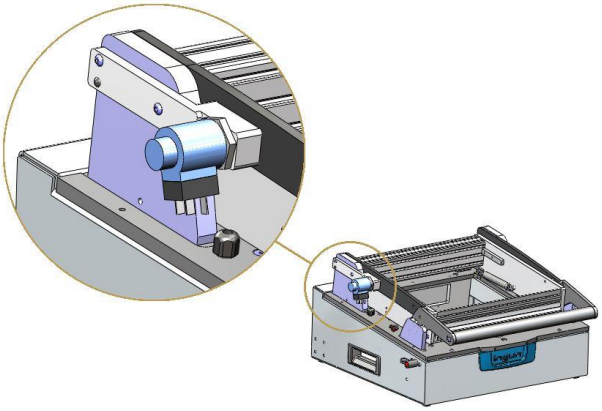
duty cycle with high current they get very hot.

5.2.11.2 FB-VER-G-ESO-MA: Stroke magnet NO (currentless; open)

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
36065				36065 (2x)	36065	

Specification of the components used:

⇒ Stroke magnet NO (currentless; open) (part (see section **9.1.9**, page 65)



5.2.11.3 FB-VER-G-P-MA: Pneumatic cylinder locking

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
49270				49270 82x)	49270	

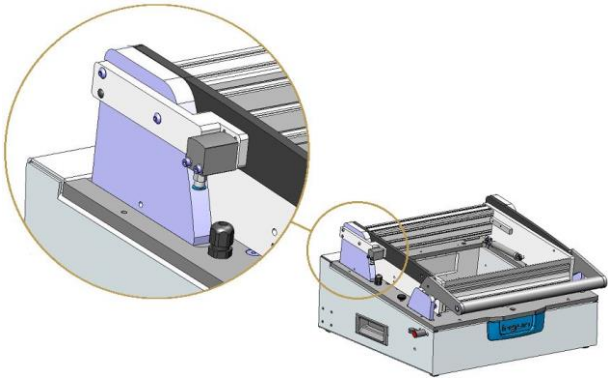
Specification of the components used:

⇒ Pneumatic cylinder 12-10 (part number 49273**)**
(see section **9.1.14**, page 66)

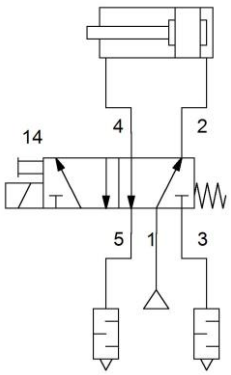
Specification of optional components (not included in delivery):

⇒ Valve assembly 5/2-way (part number 42702**)**
(see section **9.1.11**, page 65)

⇒ Compressed air combination (part number 14241**)** (see section **9.1.18**, page 67)



Pneumatic plan

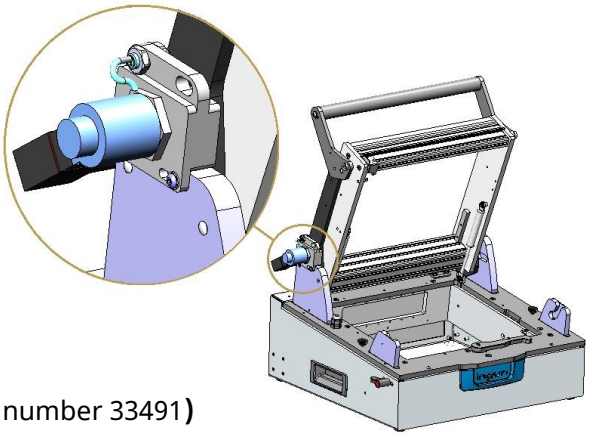


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5.2.12 FB-VER-O-ESO-MA: Locking unit for open pressure frame

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
43584				43584 (2x)	43584	

The locking unit for the opened pressure frame is then used when the closing of the pressure frame is only allowed under certain circumstances. Regarding the UUT lifting unit, for example, the pressure frame can only be closed when no UUT is present in the lifting unit.



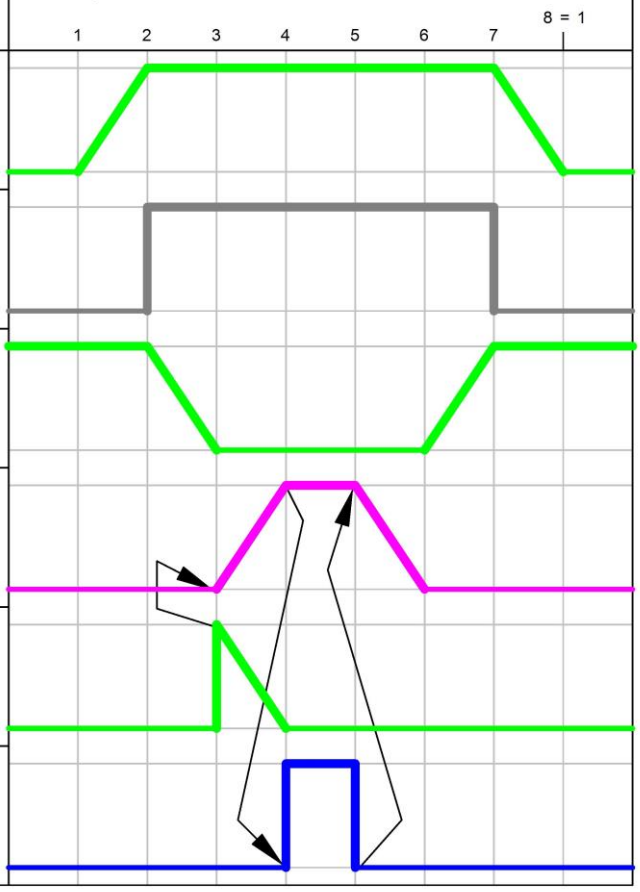
Specification of the components used:

⇒ Inductive sensor (part number 38413**)**
(see section **9.1.5,** page 64)

⇒ Stroke magnet NO (currentless; open) (part number 33491**)**
(see section **9.1.9**, page 65)

Such a test is displayed in the following functional sequence:

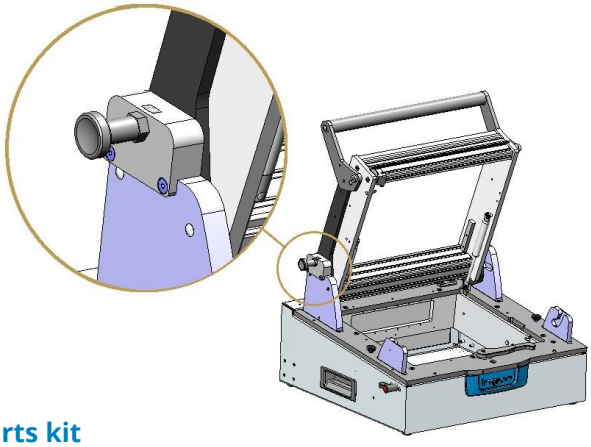
Operation	Signal < = from > = to Test Fix..	Status
Place/remove UUT/PCB		present / empty
UUT/PCB present (e.g. using SKS = switching probe)	<	active / de-active
Open/close Pressure frame		open / closed
Electromagnet or cylinder	>	active / de-active
Start (e.g. using separate push-button		active / de-active
Test	<>	active / de-active



5.2.13 FB-OBR-MA: Open pressure frame unit stop limit

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
43592				43592 (2x)	43592	

With this option the pressure frame is limited to an opening angle of approximately 45°. The limitation is achieved using a locking pin.



Note for use

⇒ The end-stroke cushioning of the gas pressure springs is not achieved with this option. Thus, a harder stop than usual can occur.

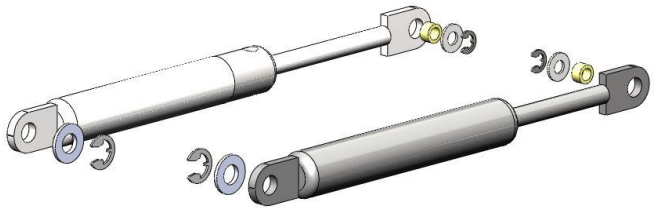
5.2.14 FB-GDF-MA: Gas pressure spring spare parts kit

MA 2x09	MA 2x11	MA 2x12	MA 2x13	MA 2x13T	MA 2x14	MA 2x15
41150	39200	39300	39400	39200 (2x)	39500	115541
-	MA 3x11	MA 3x12	MA 3x13	MA 3x13T	MA 3x14	-
-	39200	39300	39500	39200 (2x)	39500	-

The force of the gas pressure spring should allow the pressure frame to open automatically after the latch is released. If the pressure frame (NDH) is significantly heavier than the standard version (e.g., due to an RF cover, complex customisation, use of dual-stage upgrade kit), a reinforced gas pressure spring could be required.

Each type of gas pressure spring fits in each size of the test fixtures (not MA xx15), so the force can be changed according to the following table. Delivery of the kit includes one gas pressure spring and one gas pressure spring with dynamic shock absorption, as well as two bearing bushes and mounting components.

Force	Part number	
150 N	41150	
200 N	39200	
300 N	39300	
400 N	39400	
500 N	39500	
600 N	115541	Only for MA 2x15
700 N	115543	

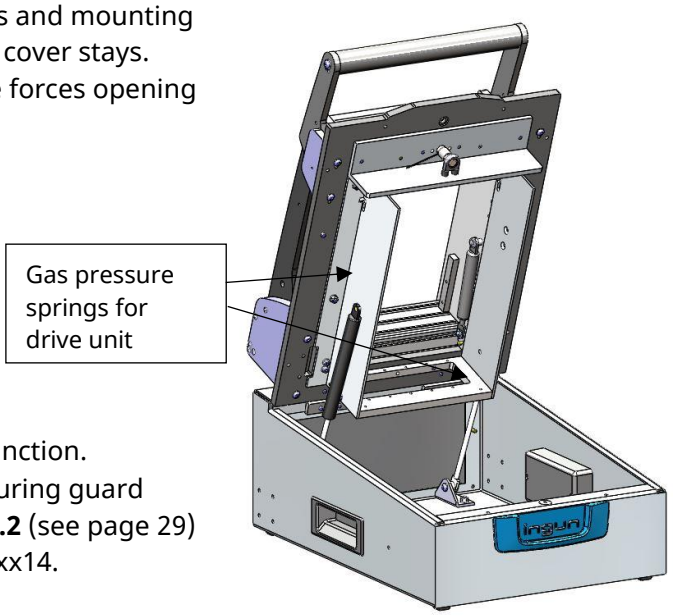


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5.2.15 FB-GDF-xxxN-MA: Gas pressure springs for drive unit (kit)

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
-	300 N = 62852 (FB-GDS-300N-MAxxxx) 400 N = 48730 (FB-GDS-400N-MAxxxx)					available

The kit includes gas pressure springs and mounting material and replaces the telescopic cover stays.
The gas pressure spring reduces the forces opening the drive unit.



Note for use:

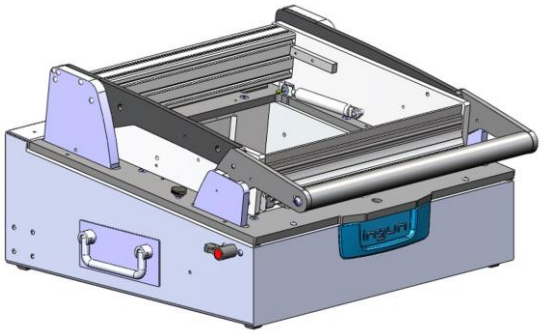
⇒ Cannot be used with self-opening function.

⇒ Combination with safety switch featuring guard detailed in sections **5.2.6.1** and **5.2.6.2** (see page 29) only possible with MA xx13 and MA xx14.

5.2.16 FB-MGK-MA: Hinged metal handle

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
47715						available

We recommend the hinged metal handle when test fixtures are very heavy or when high ESD requirements are given.



5.2.17 FB-LED-MA: Pass / fail LED indicator

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
45770		45996	115559	45770 (2x)	115560	-

The LED-strip illuminates the interior of the test fixture.

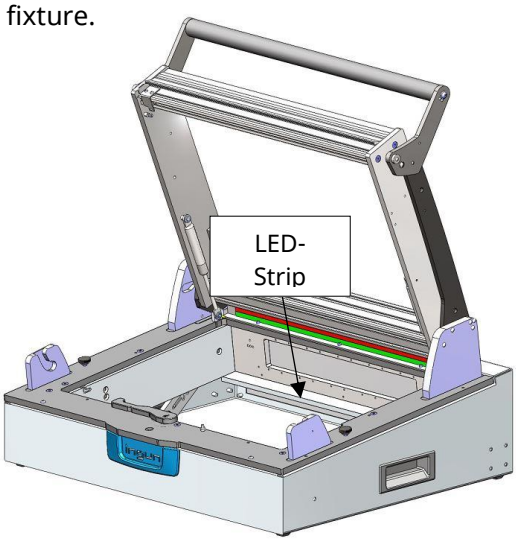
Specification of the components used:

⇒ LED SMD strip green (part number 45673**)** (see section **9.1.20**, page 67)

⇒ LED SMD strip red (part number 45674**)** (see section **9.1.21**, page 67)

⇒ Wiring using control box 42703

LiYY 3x0,14²		
D-Sub 37 male	Kabelfarbe	LEDs Streifen auf Alu-schiene
3	ws	LED Anzeige Schlecht (rt)
22	gn	LED Anzeige Gut (gn)
36 — RV —	bn	LED Anzeige +12V



5.2.18 FB-ADT-MA: Push button

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
40980						

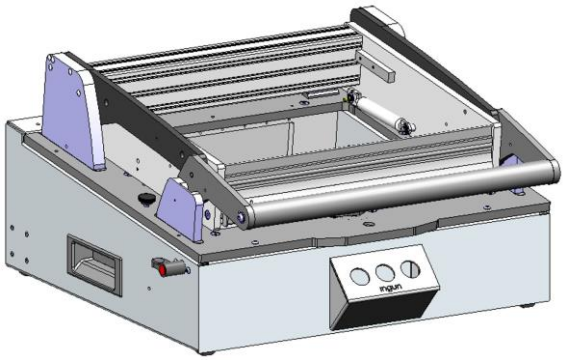
Specification of the components used (not included in delivery):

⇒ Push button yellow (part number 33466) (see section **9.1.22**, page 67)

⇒ Push button red (part number 33467) (see section **9.1.23**, page 67)

⇒ Push button green (part number 33468) (see section **9.1.24**, page 67)

⇒ Dummy plug (part number 48687)



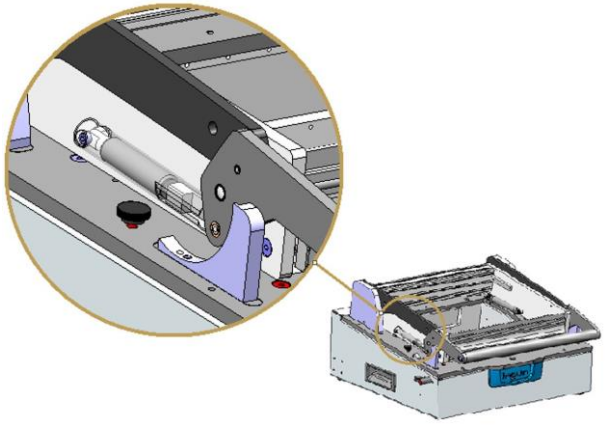
5.2.19 FB-OLB-MA: Oil break

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
-	51770			51770 (2x)	51770	

The opening-speed accelerates tremendously due to high forces caused by the high number of test probes. The oil break decreases the opening-speed considerably, improves the handling, and increases the service life.

Specification of the components used:

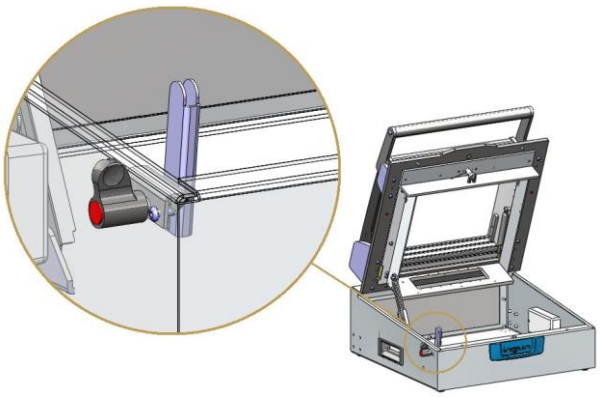
⇒ Brake cylinder D-040-12-040-123 (part number 51863) (see section **9.1.19**, page 67)



5.2.20 FB-KSG-MA: Anti-pinch protection

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
29805		Available as standard				

Due to the anti-pinch protection, there is a safety distance between the housing and the drive unit to prevent fingers accidentally getting trapped when closing. The anti-pinch protection itself has no attenuation. Therefore, the drive unit has to be place carefully on the anti-pinch protection. To close the fixture completely, the anti-pinch protection has to be pressed backwards by means of the hand lever.



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5.2.21 FB-VLK-MA: Extended handle

MA 2x09	MA 2x11	MA 2x12	MA 2x13	MA 2x13T	MA 2x14	MA xx15
	43763			43763 (2x)	43763	-
-	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	-
-		44831		44831 (2x)	44831	-

Closing force is reduced by 30% when the extended handle is used.
Compressive force in complete assembly with 2.000 N:

⇒ Standard handle: approx. 120 N
⇒ Extended handle: approx. 80 N:



5.2.22 FB-STE-LED-MAxxxx LED-Dimmer (113999)

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
			113999			

Description

The brightness of the good/bad LED display can be adjusted using the dimmer.

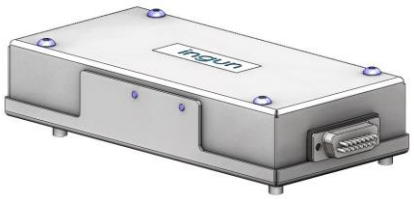


5.2.23 FB-STE-UNI-MA: MA control unit

MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
-			42703			

Description

The test procedure is programmed in the MA control unit. Different configurations are set by means of plug bridges (jumpers). All external signals are summarised on a 15-pole D-sub connector, and all internal signals are summarised on a 37-pole D-sub connector. The test procedure with the corresponding external signal inputs and outputs on the 15-pole sub connector are stated as follows:



Action	Signal	Function
Test readiness given* (start at test system) *provided that NDH is closed	Output as pass of PIN 1 to PIN 9 (without jumper = impulse, with jumper = permanent signal)	• NDH-closed locking
Change ICT -> FCT	PIN 4 und PIN 11	• Dual-stage
Test end (of test system)	Input on PIN 5 and PIN 12	• Self-opener • Marking unit
Test result (pass)	Input on PIN 6 and PIN 13	

Action	Signal	Function
(of test system)		• Pass / fail indicator • Lifting unit • NDH-open locking

After applying dual-stage signal (pulse or constant), the test fixture moves into the function test position and remains locked there. After the end-of-test signal, the test fixture unlocks. After pass signal and end-of-test signal are simultaneously applied, the test fixture unlocks and opens fully.

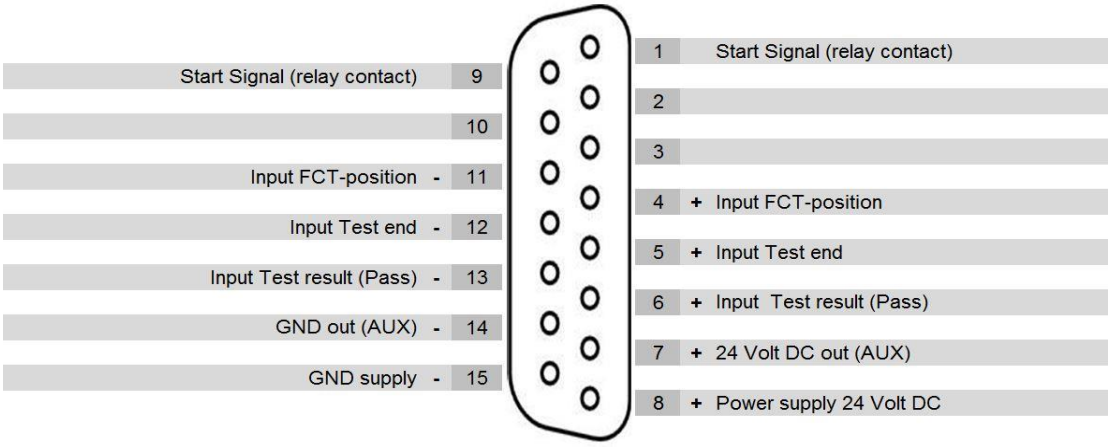
Technical data:

⇒ Output (test start): pulse (1 s) or permanent
⇒ Input (test end pass / fail): 5 to 24 V
⇒ Outside dimension (excl. sub-D connector): 150 x 80 x 40 mm (w x d x h)

Supported functions:

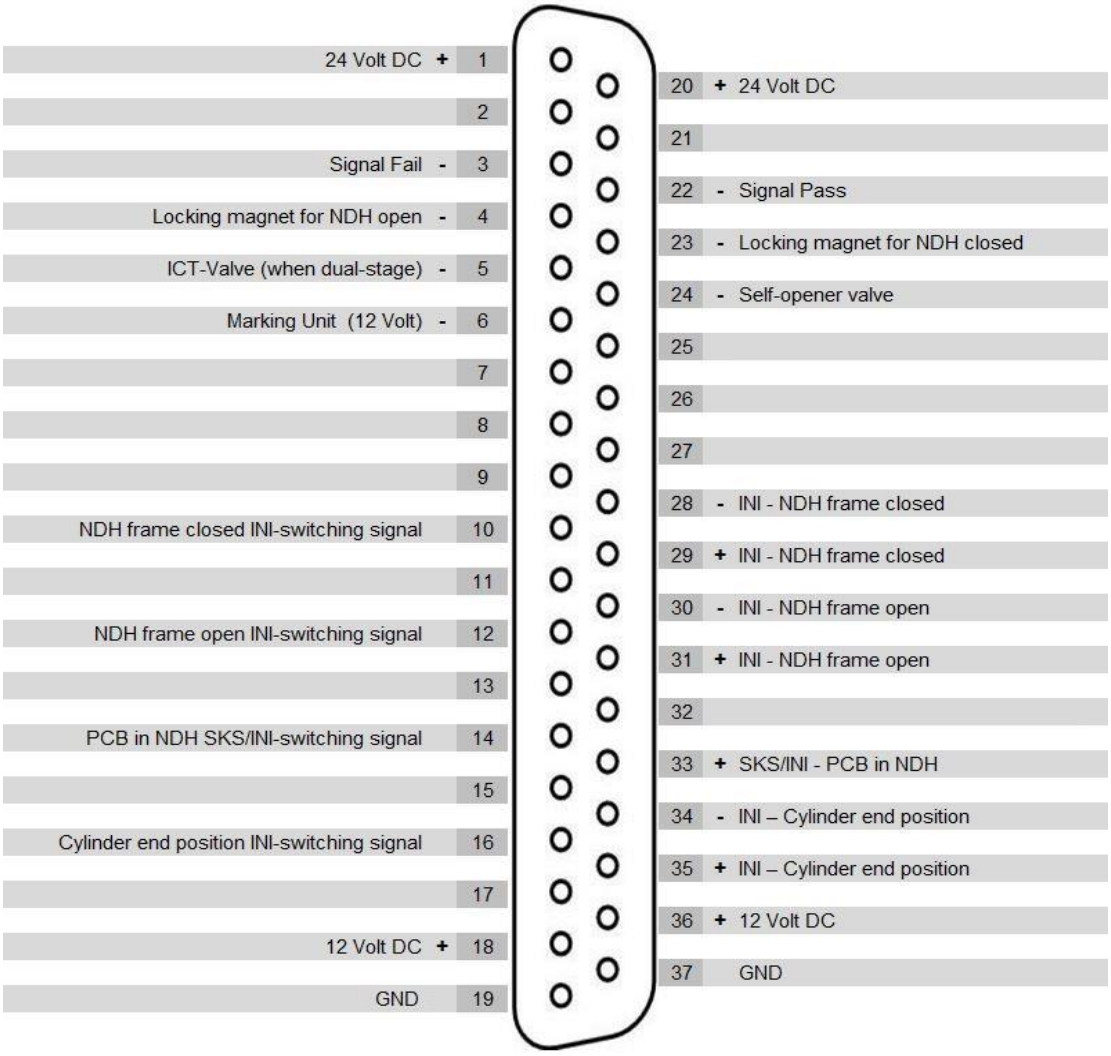
⇒ Self-opening units (see section **5.2.7**, page 33)
⇒
⇒ FB-2VM-MA: Dual-stage contacting from bottom side (no self-opening) (see section **0**, page 24) or
FB-2VM-SO: Dual-stage contacting with self-opener (see section **5.2.7**, page 26)
⇒ Locking unit for closed pressure frame (see section **5.2.11**, page 42)
⇒ FB-VER-O-ESO-MA: Locking unit for open pressure frame (see section **5.2.12**, page 44)
⇒ Lifting unit (see Operating/Assembly Instructions Manual ATS MA xx)
⇒ Marking unit
⇒ LED signal pass/fail (pass = green permanent light / fail = red flashing light)

Connection to 15-pole sub connector (external signals)

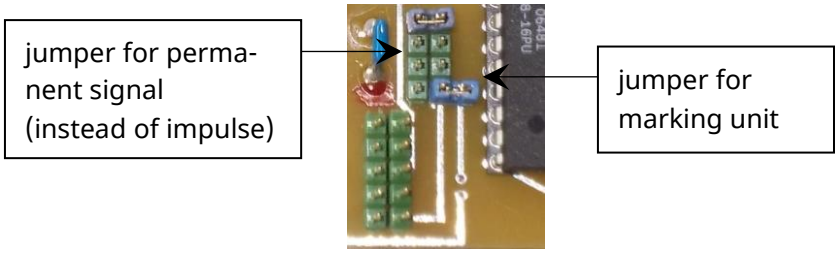


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Connection to 37-pole sub connector (signals for test fixtures internal)



Configuration



5.2.24 FB-STE-MAG-MA: Magnet control unit

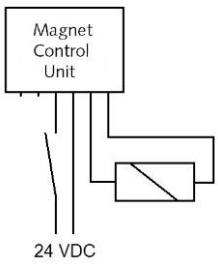
MA 2x09	MA xx11	MA xx12	MA xx13	MA xx13T	MA xx14	MA xx15
42810						

Description

The magnet control unit ensures a considerable reduction of the waste heat at the locking magnets. This is achieved with activation under full voltage (24 Volt). The magnet control unit reduces the power to one quarter after 10 second which is enough to hold the bar.



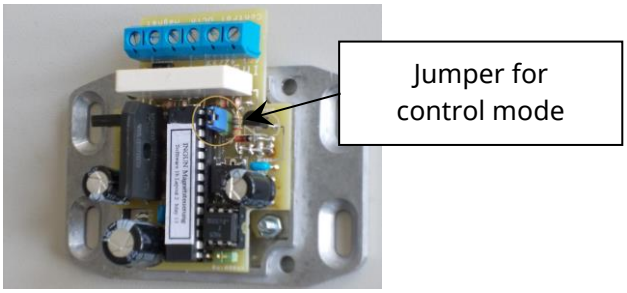
Both poles of the magnet are connected to the respectively labelled clamps. The supply voltage is connected to “DCin” (any polarity). The magnet is activated by the applied voltage.

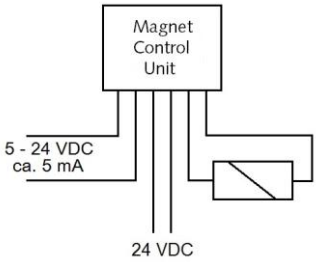




Description control mode

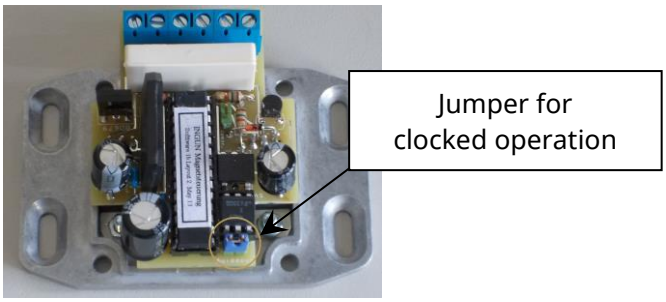
If the magnet is to be controlled by a sensor or a weak control voltage (approx. 20 mA), the control mode can be selected by means of the jumpers. The supply voltage must be permanently connected to “DCin” and the clips labelled with “Control” are connected to the control voltage (any polarity).





Description clocked operation

The magnet control unit also can be used in free waste heat chopper mode. Here the operating voltage for the magnet is clocked with approx. 4 kHz frequency. This operating mode is selected by setting the respective jumper.



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6 ADDITIONAL FUNCTIONAL UNITS ATS MAXX

The exchangeable kits are available with the following additional functional units:

6.1 ATS MAxx ../ESD: ESD version

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
See section **1.2.1.2**, page 8 for part number					-

An ESD version is available for electrostatic sensitive components. This affects the manual fixture and requires a specialised exchangeable kit. In this case, all components in the basic unit are electrically attached to the ground connection on the back panel of the basic unit. Grounding is done by the customer using a connection cable with 1.5 mm² cross section. Grounding of the bottom part takes place automatically via a spring-loaded discharge probe, assembled in the basic unit. Grounding of the top part of the exchangeable kit takes place via a grounding cable installed at the basic unit which must be plugged to the pressure frame plate.

See section **1.2.1.2**, page 8 for part number.

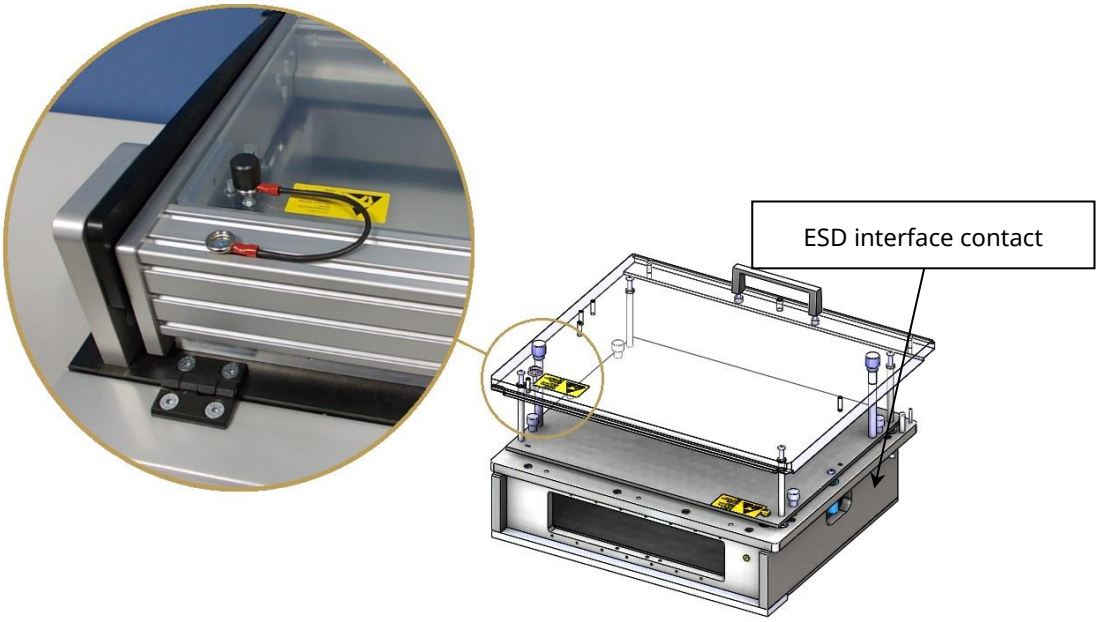


Figure 10: ATS as ESD version with pressure frame unit wiring

Notes for use

⇒ ESD function of ATS is only achieved in connection with the additional function of the ESD assembly in the test fixture (part no. 33482 or 113915 ESD assembly / part no. 43597 ESD customising with protection conductor wiring).

⇒ ESD function is only achieved with respective ESD components such as ESD pushrods and ESD pre-centring.

⇒ The ESD layer around the GKS has to be removed.

⇒ For ATS and test fixtures with ESD version of the first generation, new ESD discharge cable with ESD press-stud connector can be ordered at INGUN under part no. 48588.

(For more information see product information "Premium ESD-customising")

6.2 **ATS MAxx ../HF:** Radio-frequency version

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
See section.**1.2.1.3**, page 8 for part numbers					-

The radio-frequency exchangeable kits are used to contact highly sensitive RF boards precisely and reliably, and to measure the radio-frequency signals in a reliable manner *(see catalogue page 59-63)*.

See section.**1.2.1.3**, page 8 for part numbers

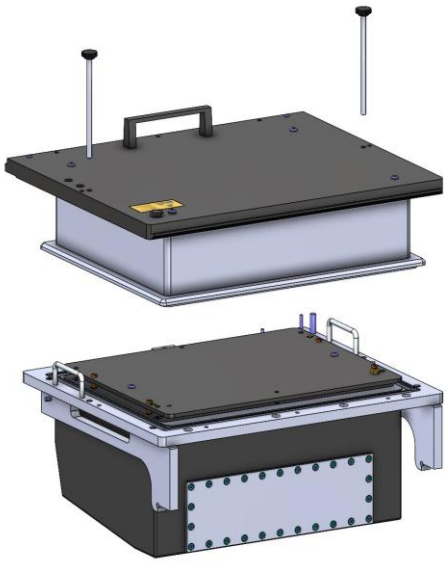


Figure 11: ATS MA12/HF/AL/ESD backside without internal interface

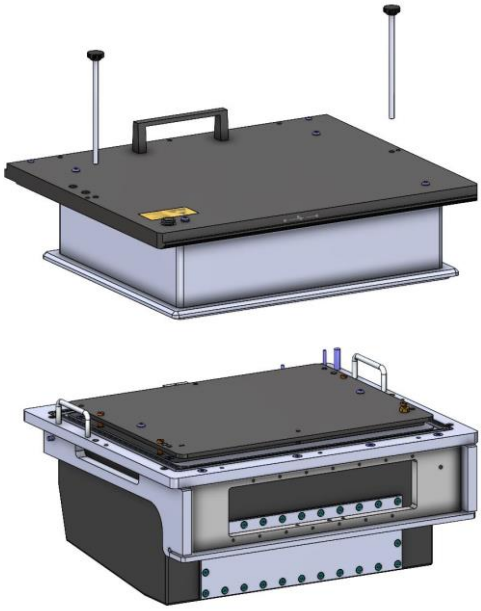


Figure 12: ATS MA12/S-7/HF/AL/ESD backside with internal interface

Spare parts and parts subject to wear can be found in catalogue Test Fixtures Spare Part Kits and Drive Units.

More information available:	**INFO 1317:** ATS MAxx series customising guidelines **INFO 2133:** RF-Transfer field **INFO 4585:** ATS MAxx RF absorber mats customising guidelines All relevant customising guidelines are summarised in the document flyer, part number 63051.

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7 OPTIONAL FUNCTIONAL UNITS FOR ATS

Using the optional functional units, the ATS can be upgraded by customers themselves. T These units are always delivered with a respective installation drawing describing the installation and, if necessary, the required operating steps.

Usually, all necessary installation fixings are already provided but sometimes machine work with respective operational expertise is required.

Generally, the **note for use** must be observed because not all optional or additional functional units can be combined and/or other aspects must be considered.

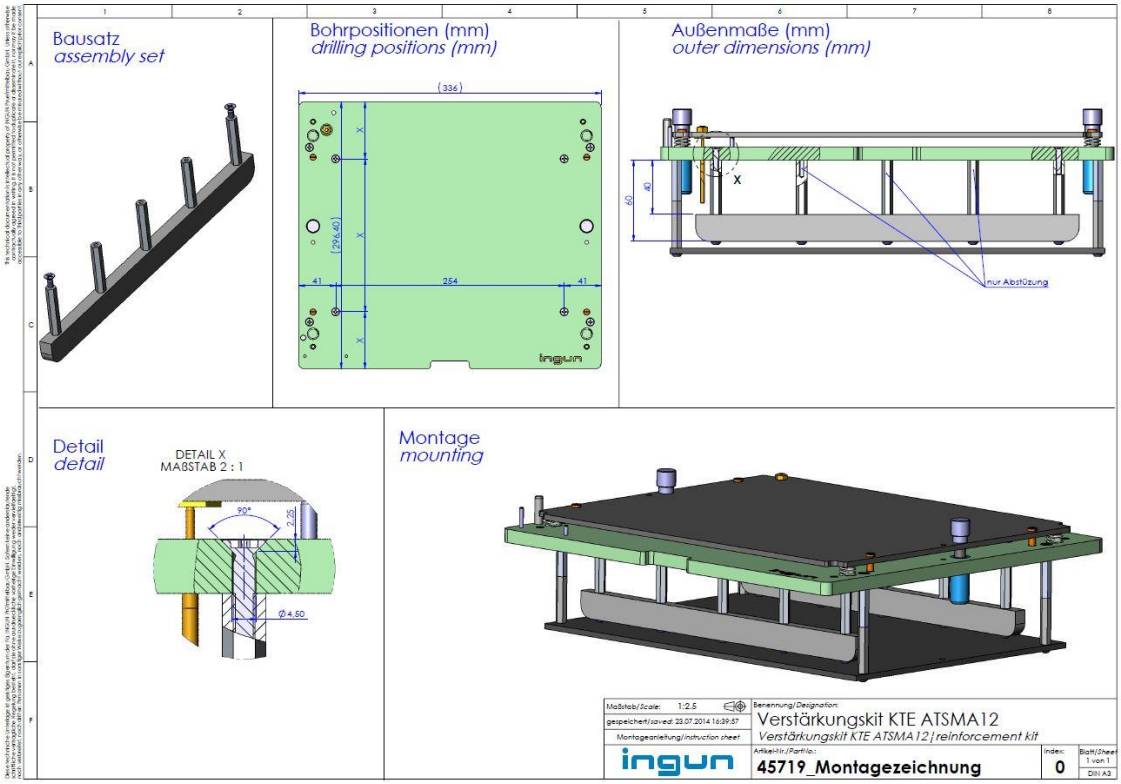


Figure 132: Example of installation instructions

7.1 FB-2SN-ATS: Dual-stage upgrade kit

Compatible with ATS version **Normal** | **ESD** | ~~**RF**~~

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
-	48266				-
MA 2x09	MA 2x11	MA 2x12	MA 2x13	MA 2x14	MA 2x15
	106834				-
-	MA 3x11	MA 3x12	MA 3x13	MA 3x14	-
	106841				-

An upgrade kit with exchangeable parts and special customising guidelines are available for the use of the ATS in a dual-stage test fixture. With this upgrade kit the height of the UUT/PC board is increased so that the longer FCT test probes do not protrude and cannot be damaged when the PC board is inserted.

More information available:	**INFO 1317:** ATS MAxx series customising guidelines

Dual-stage contacting from above is possible as a specialised solution. To request this, please contact your technical consultant at INGUN.

7.2 Reinforcement for customisations with large number of test points

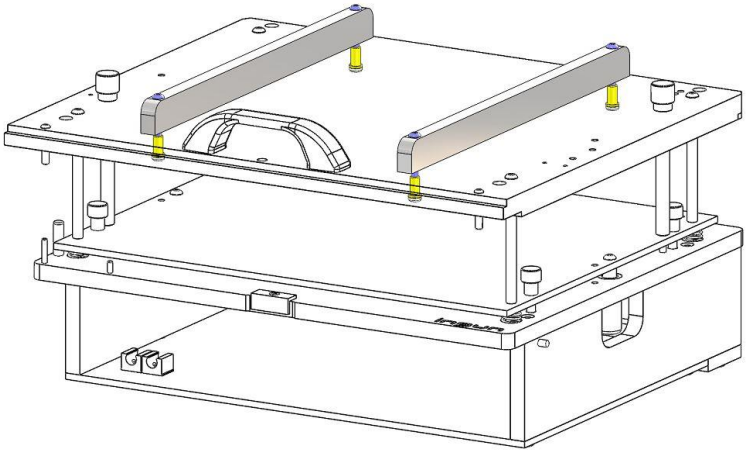
In the case of complex test applications with a large number of test points, the forces of the test probes can sometimes be very high. This can lead to deformation of the pressure frame plate (NDH) and the probe plate (KTP). With more than 300 test probes, or a force higher than 500 N, to use the additionally available reinforcement bars is recommended.

7.2.1 **FB-VSL-NDH-ATS:** Reinforcement set for pressure frame plate (NDH)

Compatible with ATS version **Normal** **ESD** ~~RF~~

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
-	46014		46013		115006

Included in delivery: mounting material for each bar

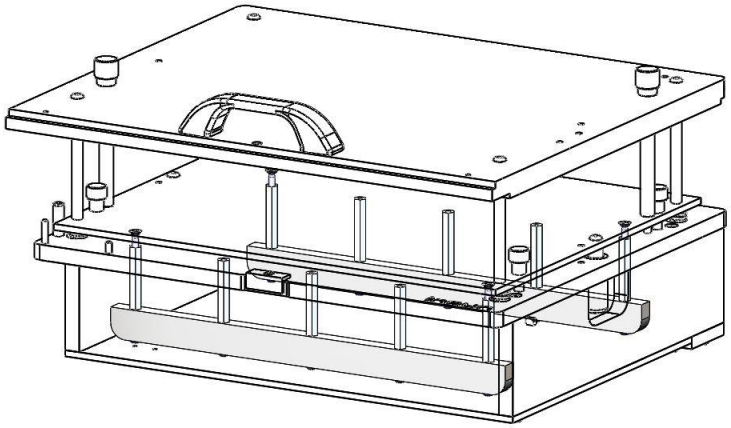


7.2.2 **FB-VSL-KTE-ATS:** Reinforcement set for probe plate unit (KTE)

Compatible with ATS version **Normal** **ESD** ~~RF~~

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
-	-	45719	46861	46863	115008

Included in delivery: mounting material for each bar



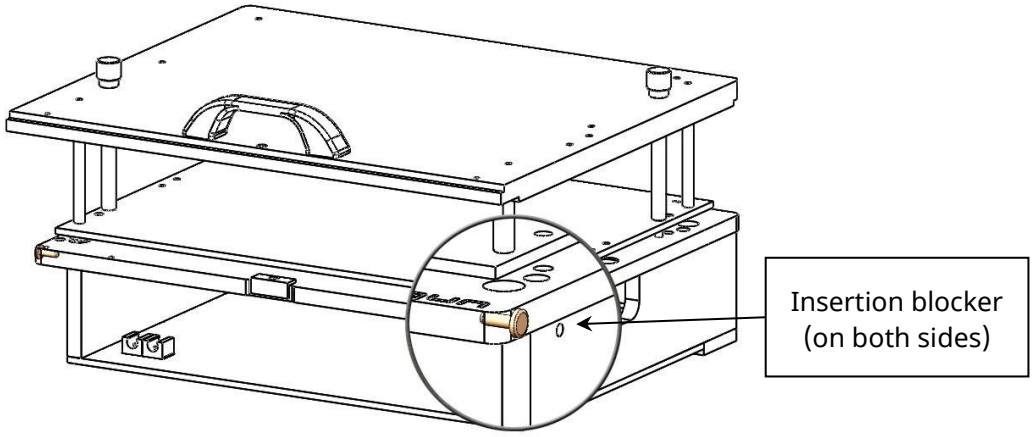
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7.3 FB-ELS-22-ATS: Insertion blocker for 22mm stroke

Compatible with ATS version **Normal** | **ESD** | ~~RF~~

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
47730					-

Included in delivery: two stop bolts

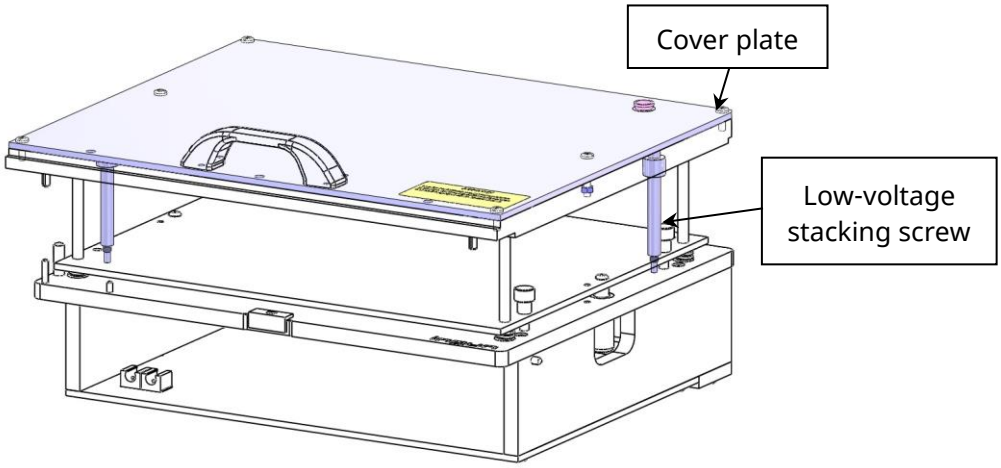


7.4 FB-BSP-ATS: Protective cover for hazardous voltage

Compatible with ATS version **Normal** | **ESD** | ~~RF~~

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
41809	41811	41812	41813	41814	-
MA 2x09 113130	MA xx11 112471 MA xx13T 112475	MA xx12 112472	MA xx13 112473	MA xx14 112474	MA xx15 -

When testing at a hazardous voltage (>25V AC and >60V DC), the exchangeable kit must be equipped with contact protection, and the IP3x protection according to DIN EN 60529 must be fulfilled.



WARNING: When customising, care must be taken to ensure that all cables carrying dangerous voltages are as short as possible and, if necessary, also fixed in place. (This will prevent cables from coming into contact with operating elements in the front area of the test fixture in case of possible cable breakage).

7.5 FB-AHE-ATS: Lifting units

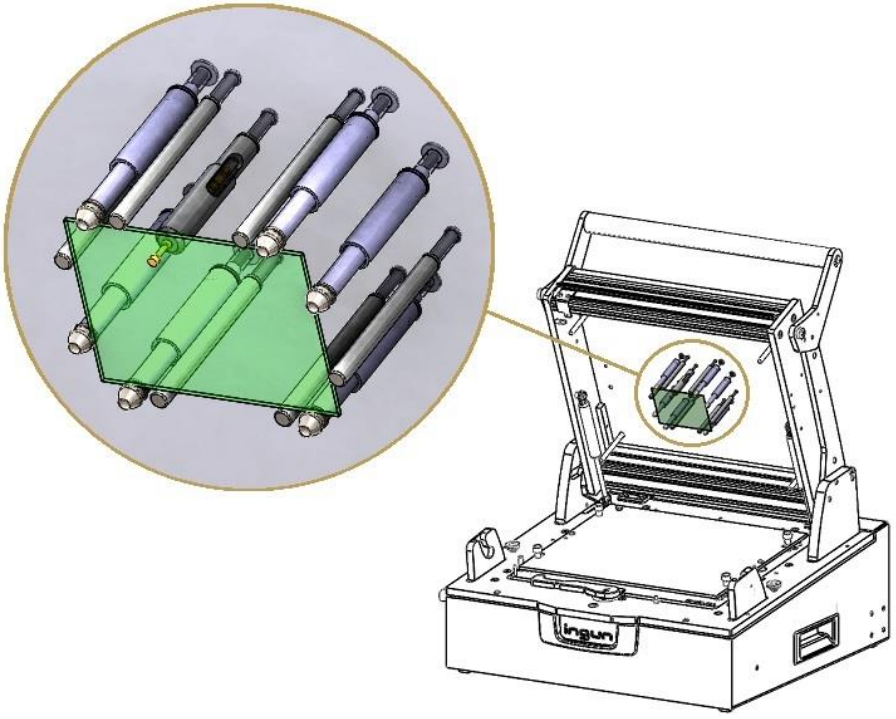
Compatible with ATS version | **Normal** | **ESD** | **RF**

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
42741 (single bending pin 42731)					

Lifting units are used to lift tested PC boards automatically from their probe field and to move them up safely when opening the pressure frame. The PC board which is properly aligned between limiting pins is fixed using bending pins for quick removal. The open pressure frame can be locked in the “open” position using the stroke magnet of the locking unit NDH. This situation remains until the PC board ’is removed from the lifting unit – it’s presence is detected by a spring-loaded switching probe.
Included in delivery: six bending pins, six limiting pins and one SKS-check.

Note for use

⇒ The lifting unit cannot be used in case of contacting from above.



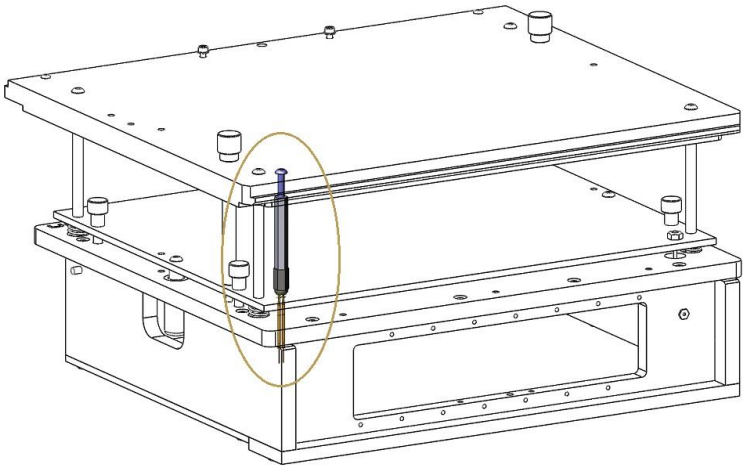
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7.6 Closed pressure frame detection

7.6.1 FB-ABF-G-GKS-ATS: Closed pressure frame detection using two GKS

Compatible with ATS version | **Normal** | **ESD** | **RF**

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
46396					



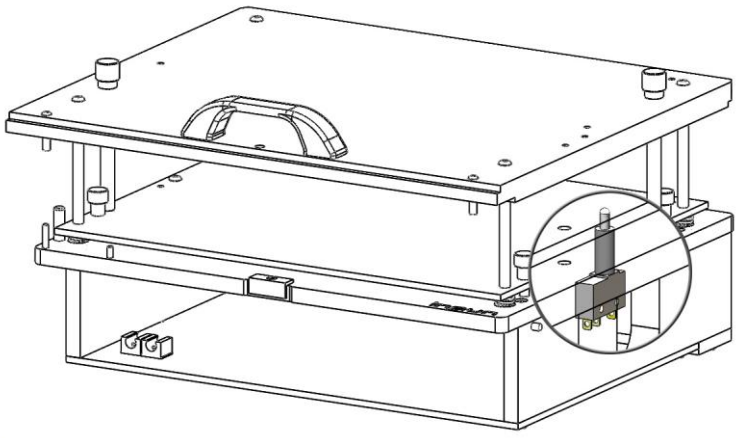
Note for use

⇒ Not suitable for dual-stage function

7.6.2 FB-ABF-K-S-ATS : Closed for pressure frame detection with stroke switch

Compatible with ATS version | **Normal** | **ESD** | **RF**

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
33510					



Note for use

⇒ Not suitable for dual-stage function

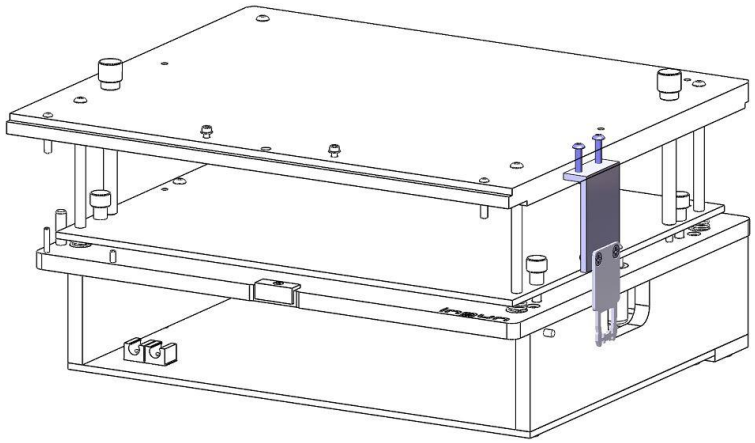
7.7 Actuator for safety switch with and without locking

7.7.1 **FB-BTV-ATS:** Actuator for single-stage contacting

Compatible with ATS version **Normal** | **ESD** | **RF**

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
100414	36455				
MA 2x09	MA xx11/13T	MA xx12	MA xx13	MA xx14	MA xx15

36210 = with locking NO (currentless; open)
46020 = with locking NC (currentless; closed)
42066 = without locking

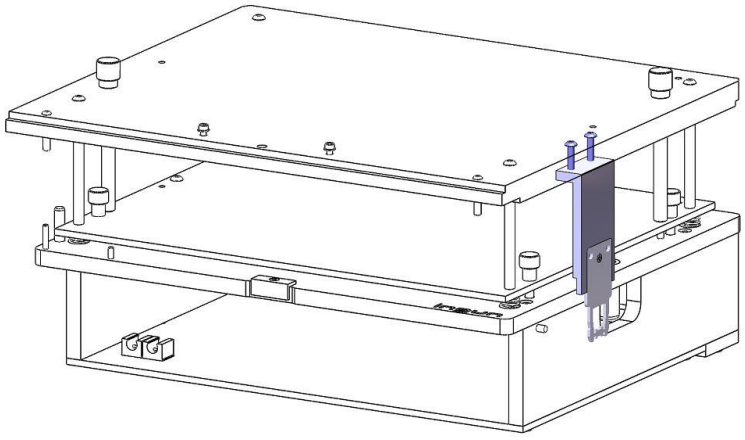


7.7.2 **FB-BT2-ATS:** Actuator for dual-stage contacting (basic unit)

Compatible with ATS version **Normal** | **ESD** | ~~**RF**~~

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
103273	47740				-
MA 2x09	MA xx11/13T	MA xx12	MA xx13	MA xx14	MA xx15

36210 = with locking NO (currentless; open)
46020 = with locking NC (currentless; closed)
42066 = without locking



Note for use

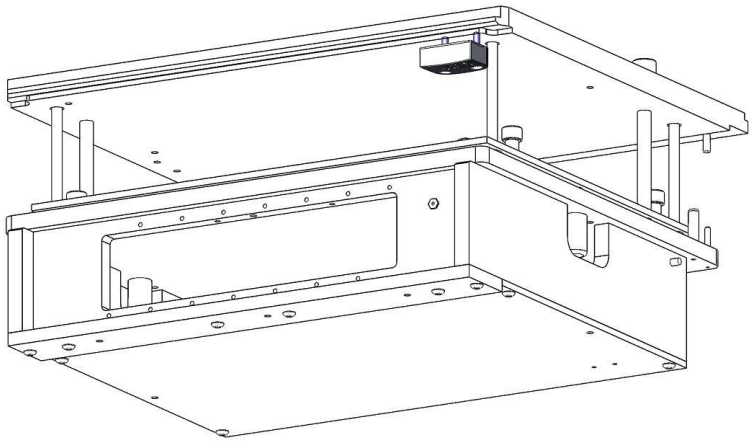
⇒ When testing at a hazardous voltage, the protection type IP3x according to DIN EN 60529 must be fulfilled.

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7.7.3 **FB-BTM-ATS:** Actuator for magnetic safety switch

Compatible with ATS version **Normal** | **ESD** | ~~RF~~

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
41552					-
MA 2x09	MA xx11/13T	MA xx12	MA xx13	MA xx14	MA xx15
41560		41558	41556	41553	-



Note for use

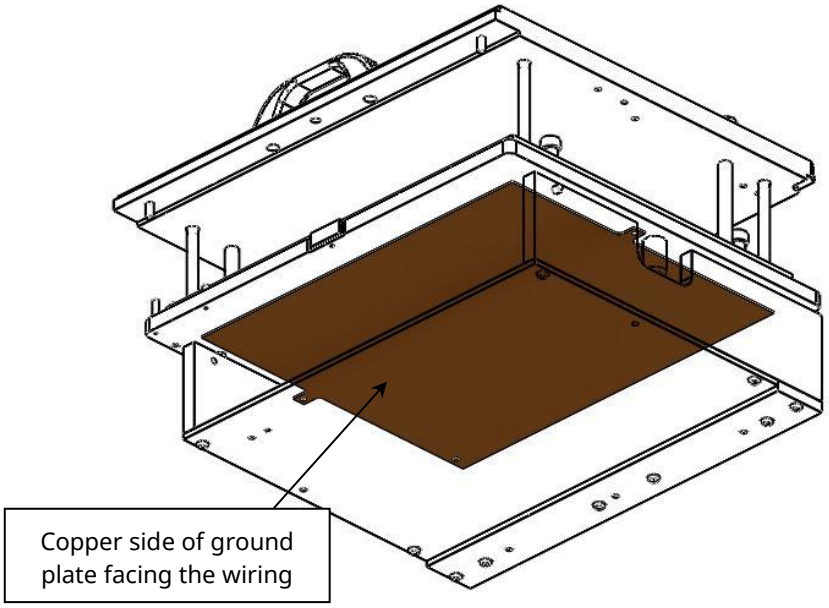
⇒ Not suitable for dual-stage function

7.8 **MAP-ATSMA:** Ground plate for exchangeable kits **(ATS)**

Compatible with ATS version **Nor-** | **ESD** | ~~RF~~

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
45873	45874	45881	45882	45883	-

With twisted pair wiring or coaxial cable, the shielding (mass) is normally wired on an additional ground plate.



Note for use

⇒ All test probes (GKS) in the ground plate must be drilled with larger diameter than the GKS diameter.

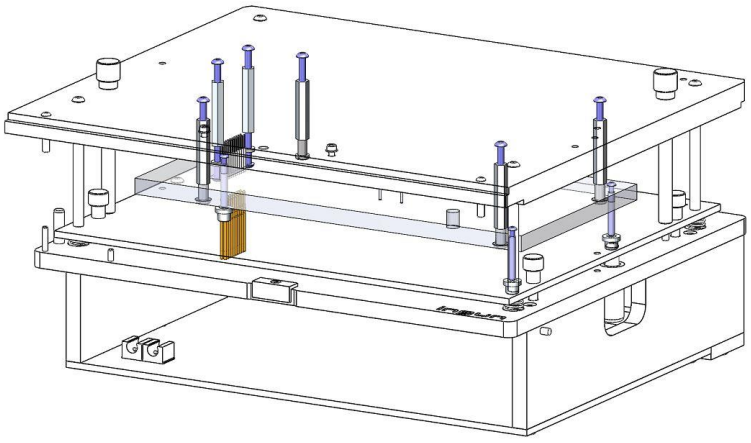
7.9 Contacting from top side (mounting kit)

7.9.1 FB-ZSK-ATS; Standard exchangeable kits

Compatible with ATS version: Normal | ESD | RF

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
22652-KIT					

Included in delivery: six hexagon bolts, four collar screws, three headed drill bushes, two distance rolls with screws and pins (without acrylic glass plate and transfer field).



Note for use

⇒ Not suitable for dual-stage function

7.9.2 FB-ZSK-ESD-ATS: ESD exchangeable kits

Compatible with ATS version: ~~Normal~~ | ESD | ~~RF~~

ATS MA09	ATS MA11	ATS MA12	ATS MA13	ATS MA14	ATS MA15
45704-KIT					-

Included in delivery: ESD discharge cable, six hexagon bolts, four collar screws, three headed drill bushes, two distance rolls with screws and pins (without acrylic glass plate and transfer field).

Note for use

⇒ Not suitable for dual-stage function

8 FURTHER MAINTENANCE

Maintenance work for routine test operation is described in the operating instructions for the MA xxxx test fixture.

8.1 ATS alignment check

The original alignment of ATS is normally sustained for the total duration period of the test fixture. Nevertheless, checks may be necessary - especially when the test fixture has been subject to an extremely high force caused by e.g., impact or fall. Furthermore, the alignment can also be affected by manipulation of the functional parts such as e.g., hinges or other connecting parts. Therefore, INGUN recommend periodically checking the centring accuracy.

The INGUN exchangeable kits both have two ∅4 centering holes (the referenceholes); one in the probe plate and one in the exchangeable pressure frame unit. The alignment of both parts can be checked in the test fixture using two long cylindrical pins. If the cylindrical pins cannot be inserted easily into the holes, readjustment is necessary.

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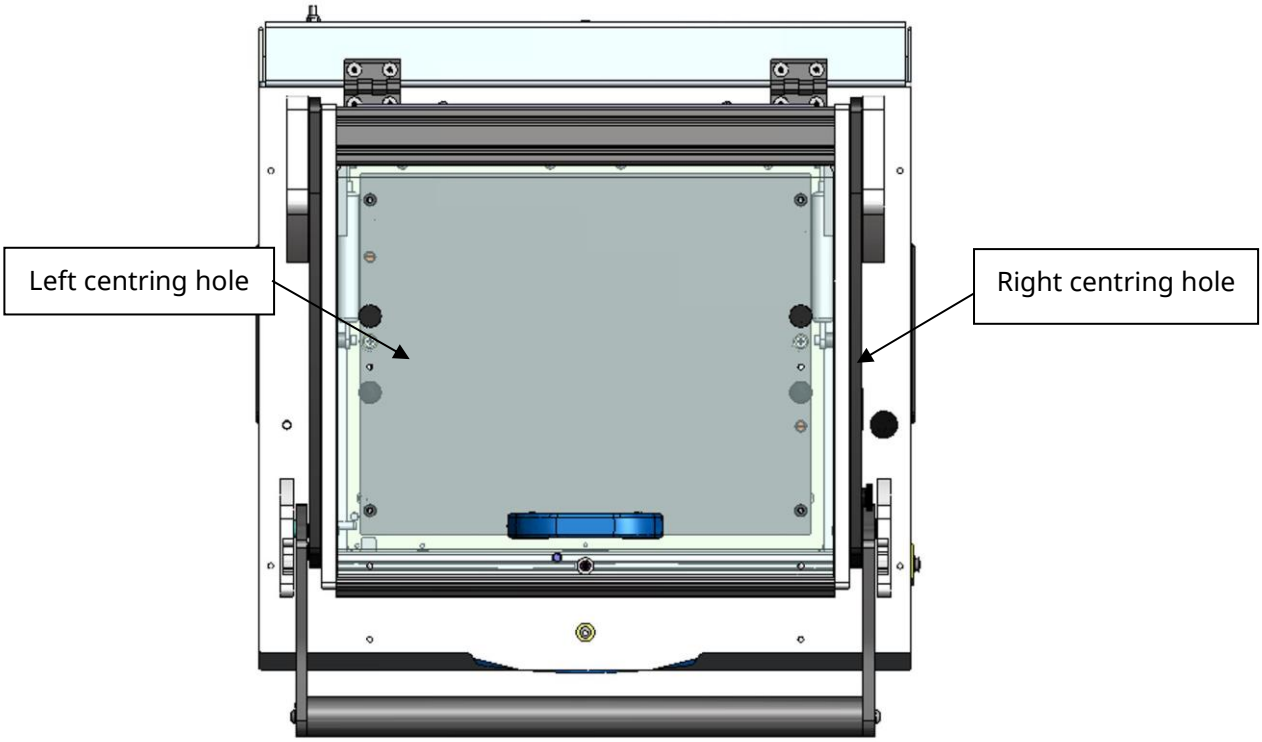


Figure 13: Centring holes in the exchangeable kits

Readjustment must be carried out very carefully.

8.2 Replacement parts and worn parts MA xxxx

Spare parts are required for preventative maintenance, or as soon as a component of a complex product wears out adue to normal operation in the course of its working life. This wear can result in the function of the product being limited or ceasing altogether.

(see catalogue Test Fixtures Spare Part Kits and Drive Units).



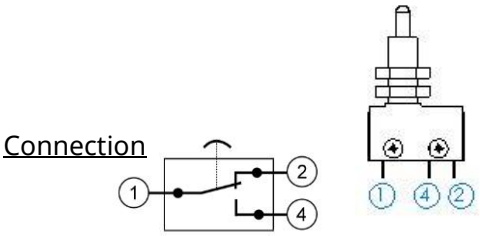
9 TECHNICAL DATA

9.1 Specification of components used

9.1.1 Stroke switch (part number 20202)

Set-up of contact: 5 A 250 VAC
Release force: 0.1 N
Connection terminal type: solder

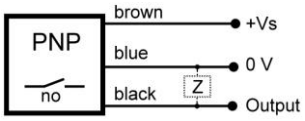
Connection



9.1.2 Inductive sensor (part number 26466)

Type: inductive sensor
Type/design: flush
Switching display: LED yellow
Start switch setting: PNP closer (NO)
Switching frequency: 5 kHz
Operational voltage range: 10 - 30 VDC
Current consumption: 5.5 mA
Current setting: < 100 mA
Protection type: IP 67
Working temperature: -25 - +70 °C
Switching distance: 0.6 mm (Aluminium)

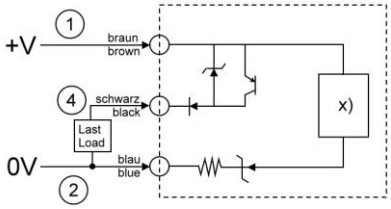
Connection



9.1.3 Inductive sensor M8x1 (part number 33831)

Type: inductive sensor
Type/design: flush
Switching display: LED yellow
Start switch setting: PNP closer (NO)
Switching frequency: 1500 Hz
Operational voltage range: 10 - 32 VDC
Current consumption: 10 mA
Current setting: < 200 mA
Protection type: IP 67
Working temperature: -25 - +70 °C
Switching distance: 1.2 mm (Aluminium)

Connection

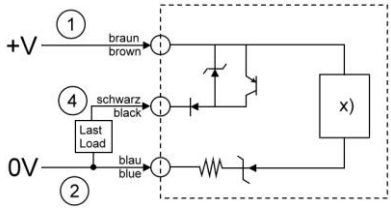


x) = Main switching circuit of proximity sensor

9.1.4 Inductive sensor (part number 36684)

Type: inductive sensor
Type/design: not flush
Switching display: LED yellow
Starting voltage: PNP closer (NO)
Switching frequency: 1500 Hz
Operation voltage range: 10 - 32 VDC
Current rating: 10 mA
Starting current: < 200 mA
Protection type: IP 67
Working temperature: -25 - +70 °C
Switching distance: 1.9 mm (aluminium)

Connection



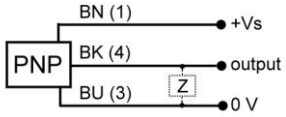
x) = Main switching circuit of proximity sensor

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9.1.5 Inductive sensor (part number 38413)

Type:	inductive sensor
Switching status display:	LED red
Start switching status:	PNP closing contact (NO)
Switching frequency:	5 kHz
Nominal voltage:	10 - 30 VDC
Current consumption max.:	12 mA
Output current:	<200 mA
Protection category:	IP 67
Working temperature:	-25 - +75 °C
Nominal switching distance:	2 mm

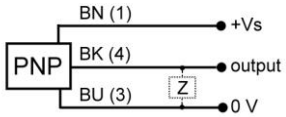
Connection



9.1.6 Inductive sensor (part number 44833)

Type:	inductive sensor
Switching status display:	LED yellow
Start switching status:	PNP closing contact (NO)
Switching frequency:	2 kHz
Nominal voltage:	10 - 30 VDC
Current consumption max.:	<15 mA
Output current:	100 mA
Protection category:	IP 65
Working temperature:	-25 - +75 °C
Nominal switching distance:	1.2 mm

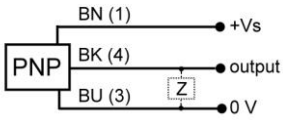
Connection



9.1.7 Inductive sensor (part number 111136)

Type:	inductive sensor
Switching status display:	LED
Start switching status:	PNP closing contact (NO)
Switching frequency:	5 kHz
Nominal voltage:	10 - 30 VDC
Current consumption max.:	<10 mA
Output current:	100 mA
Protection category:	IP 67
Working temperature:	-25 - +70 °C
Nominal switching distance:	0,6 mm

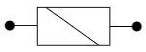
Connection



9.1.8 Stroke magnet NC (currentless; closed) (part number 28194)

Nominal voltage:	24 VDC
Power consumption:	11 Watt (450 mA)
Switching duration:	100 %

Connection



(polarity optional)

For reduced continuous operation *(see section **2.1.4**, page 13)*

Recommended series resistor:	47 Ohm / ≥10 W

9.1.9 Stroke magnet NO (currentless; open) (part number 33491)

Nominal voltage: 24 VDC
Power consumption: 8 Watt (300 mA)
Switching duration: 100 %

Connection



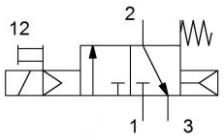
(polarity optional)

For reduced continuous operation *(see section **2.1.4**, page 13)*
Recommended series resistor: 75 Ohm / ≥10 W

9.1.10 Valve assembly 3/2-way (part number 43583)

Part number valve: 41752
Part number cable: 36547
Valve operation: 3/2 closed, mono-stable
Operating air pressure: 0.9 – 10 bar
Pneumatic connection: M5
Return type: Mixed, pneumatic/ mechanical
Ambient and medium temperature: -5 - 50 °C
Nominal voltage: 24 VDC
Power: 1 W
Display: LED

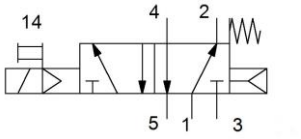
Function chart



9.1.11 Valve assembly 5/2-way (part number 42702)

Valve part no.: 36541
Cable part no.: 36547
Valve operation: 5/2 control valve, mono-stable
Operating air pressure: 0.9 – 10 bar
Pneumatic connection: M5
Return type: mixed, pneumatic/ mechanical
Ambient and medium temperature: -5 - 50 °C
Nominal voltage: 24 VDC
Power: 1 W
Display: LED

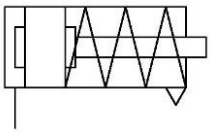
Function chart



9.1.12 Pneumatic cylinder 12-10 (part number 49273)

Function: single-action, compression
Plunger diameter: 12 mm
Stroke: 10 mm
Theoretical force with 6 bar: 61 N
Operating pressure: 0.6 – 10 bar
Pneumatic connection: M5

Function chart

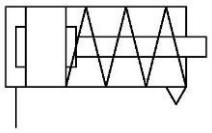


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9.1.13 Pneumatic cylinder 12-10 (part number 43251)

Function:	single-action, compression
Plunger diameter:	12 mm
Stroke:	10 mm
Theoretical force with 6 bar:	59.5 N
Operating pressure:	0.6 – 10 bar
Pneumatic connection:	M5

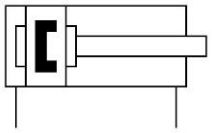
Function chart



9.1.14 Pneumatic cylinder 12-10 (part number 49273)

Function:	double-action
Plunger diameter:	12 mm
Stroke:	10 mm
Theoretical force with 6 bar:	Advance 68 N, Return 51 N
Operating air-pressure:	0.6 – 10 bar
Pneumatic connection:	M5

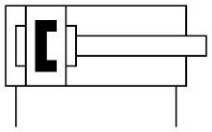
Function chart



9.1.15 Pneumatic cylinder 25-50 (part number 39203)

Function:	double-action
Plunger diameter:	25 mm
Stroke:	50 mm
Theoretical force with 6 bar:	Advance 295 N, Return 247 N
Operating air-pressure:	0.6 – 10 bar
Pneumatic connection:	G1/8

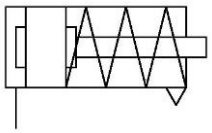
Function chart



9.1.16 Pneumatic cylinder 32-10 (part number 39673)

Function:	single-action, compression
Plunger diameter:	32 mm
Stroke:	10 mm
Theoretical force with 6 bar:	450 N
Operating pressure:	0.6 – 10 bar
Pneumatic connection:	G1/8

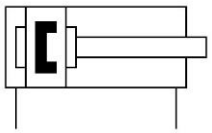
Function chart



9.1.17 Pneumatic cylinder 32-30 (part number 28235)

Function:	double-action
Stroke:	30 mm
Plunger diameter:	32 mm
Theoretical force with 6 bar:	Advance 483 N, Return 415 N
Operating air-pressure:	0.6 – 10 bar
Pneumatic connection:	G1/8
Cylinder switch:	part no.: 25638 (not initially supplied)

Function chart



9.1.18 Compressed air combination (part number 14241)

Coupling socket part no.:	2883
Connecting plug part no.:	1560
Hose size:	PK6

9.1.19 Brake cylinder D-040-12-040-123 (part number 51863)

Function:	cushioning in two directions
Stroke:	40 mm
Maintenance:	none
Ambient temperature:	-20°C to 80°C

9.1.20 LED SMD strip green (part number 45673)

Colour of light:	green
Luminosity:	800 mcd
Wavelength:	515-525 nm
Operating voltage:	12 Volt
Operating current (max. 33 LEDs):	approx. 200 mA

9.1.21 LED SMD strip red (part number 45674)

Colour of light:	red
Luminosity:	300 mcd
Wavelength:	620-635 nm
Operating voltage:	12 Volt
Operating current (max. 33 LEDs):	approx. 200 mA

9.1.22 Push button yellow (part number 33466)

LED colour:	yellow
Contact rated current:	100 mA @ 24 VDC
Switching run:	momentary
IO protection type:	IP 67
Operating voltage	-25°C to 70°C

9.1.23 Push button red (part number 33467)

LED colour:	red
Contact rated current:	200 mA @ 42 VDC
Switching run:	momentary
IO protection type:	IP 67
Operating voltage:	-25°C to 70°C

9.1.24 Push button green (part number 33468)

LED colour:	green
Contact rated current:	200 mA @ 42 VDC
Switching run:	momentary
IO protection type:	IP 67
Operating voltage:	-25°C to 70°C

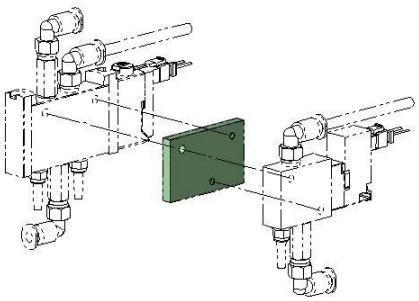
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9.1.25 Valve mounting part (part number 57022)

Mounting plate for the attachment of:

Valve 1: 5/2- control valve (part no. 42702)

Valve 2: 3/2- control valve (part no. 43583)



Key:	
ok	Application possible
NO	Application not possible
XX	Application not recommended
rec.	Application recommended
incl.	Component included in option
ess.	Essential combination

Designation re: installation of functional unit

	Subsequent installation possible without additional working steps
	Subsequent installation possible with additional working steps

Item No.	Catalogue page	Chapter in THB	Description of functional unit	Short designation	Part number
1	68	5.1	MA Protection conductor wiring and contact protection for dange	**FB-SLV-MA**	113130, 112471, 112472, 112473, 112474, 112475
2	68	5.2	MA ESD assembly	**FB-ESD-MA**	33482, 113915
3	68	5.3	MA ESD assembly and protection conductor wiring	**FB-ESD-S-MA**	43597, 113081
4	68	5.4	Mechanical 2-stage locking unit	**FB-2VM-MA**	106834, 106841
5	68	5.5	Mechanical 2-stage locking unit with electric motor	**FB-2VM-SO**	110515, 110538
6	69	5.6.1	MA Safety switch with locking NO (currentless; open)	**FB-SIS-ZSO-MA**	36210
7	69	5.6.2	MA Safety switch with locking NC (currentless; closed)	**FB-SIS-ZSG-MA**	46020
8	69	5.6.3	MA Safety switch without locking	**FB-SIS-MA**	42066
9	69	5.6.4	MA Magnetic safety switch	**FB-SIS-BM-MA**	41560, 41558, 41556, 41553
10	70	5.7.1	MA Self-opener pneumatic	**FB-SOP-MA**	42701, 42700
11	70	5.7.2	MA Self-opener electric	**FB-SOE-MA**	45220
12	5	5.8.1	Automatic opener/closer	**FB-OSA-E-MA**	113401, 114263, 114445, 114503, 114535
13	6	5.8.2	Safety switch	**FB-SIS-SOA-MA**	113450, 114287, 114316, 114509, 114826
14	70	5.9.1	MA Check for pressure frame closed via stroke switch	**FB-ABF-G-S-MA**	33840
15	70	5.9.2	MA Check for pressure frame closed stroke position by inductive	**FB-ABF-G-I-MA**	37550
16	70	5.9.3	MA Check for pressure frame closed position by inductive sensor	**FB-ABF-V-I-MA**	43625, 46745
17	71	5.10	MA Check ATS locked	**FB-ABF-V-SKS-MA**	43246
18	71	5.11.1	MA Locking unit for closed pressure frame stroke magnet NC (cu	**FB-VER-G-ESG-MA**	32665
19	71	5.11.2	MA Locking unit for closed pressure frame stroke magnet NO (cu	**FB-VER-G-ESO-MA**	36065
20	71	5.11.3	MA Locking unit for closed pressure frame pneumatic cylinder lo	**FB-VER-G-P-MA**	49270
21	71	5.12	MA Locking unit for pressure frame open	**FB-VER-O-ESO-MA**	43584
22	71	5.13	MA Pressure frame unit opening limited	**FB-OBR-MA**	43592
23	72	5.15	MA Gas pressure springs for the drive unit (kit)	**FB-GDF-400N-MA**	48730, 62852
24	72	5.16	MA Hinged metal handle	**FB-MGK-MA**	47715
25	72	5-17	MA Pass / fail LED indicator	**FB-LED-MA**	45770, 45996, 45999, 46000
26	72	5.18	MA Push button	**FB-ADT-MA**	40980
27	72	5.19	MA Oil break	**FB-OLB-MA**	51770
28	72	5.20	MA Anti-pinch protection	**FB-KSG-MA**	29805
29	73	5.21	MA Extended handle	**FB-VLK-MA**	43763, 44831
30	73	5.22	MA Control unit	**FB-STE-UNI-MA**	42703
31	73	5.23	MA Magnet control unit	**FB-STE-MAG-MA**	42810
32	36 ff.	6.1	ATS ESD version	**ATS MAxx ../ESD**	46026, 46248, 46236, 46250, 46239, 46254, 46242
33	37 ff.	6.2	ATS Radio frequency version	**ATS MAxx ../HF/AL/ESD**	154011, 154012, 154013, 154014, 154111, 154112, 154113, 154114
34	73	7.1	ATS Dual-stage upgrade kit	**FB-2SN-ATS**	48266
35	73	7.2.1	ATS Stiffener kit for NDH	**FB-VSL-NDH-ATS**	46013, 46014, 115006
36	73	7.2.2	ATS Stiffener kit for KTE	**FB-VSL-KTE-ATS**	45719, 46861, 46863, 115008
37	74	7.3	ATS Insertion blocker for stroke 22mm	**FB-ELS-22-ATS**	47730
38	74	7.4	ATS Contact protection for dangerous voltage	**FB-BSP-ATS**	41809, 41811, 41812, 41813, 41814
39	74	7.5	ATS Lifting units	**FB-AHE-ATS**	42741, (42731)
40	74	7.6.1	ATS Check for pressure frame closed using two GKS	**FB-ABF-G-GKS-ATS**	46396
41	74	7.6.2	ATS Check for pressure frame closed via stroke switch	**FB-ABF-K-S-ATS**	33510
42	74	7.7.1	ATS Actuator for single-stage	**FB-BTV-ATS**	100414, 36455
43	75	7.7.2	ATS Actuator for dual-stage (basic unit)	**FB-BT2-ATS**	103273, 47740
44	75	7.7.3	ATS Actuator for magnetic safety switch	**FB-BTM-ATS**	41552
45	75	7.8	ATS Ground plate for ATS	**MAP-ATSMAxx**	45873, 45874, 45881, 45882, 45883
46	75	7.9.1	ATS Contacting from above, normal assembly	**FB-ZSK-ATS**	22652
47	75	7.9.2	ATS Contacting from above, ESD assembly	**FB-ZSK-ESD-ATS**	45704

Item No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
	MA Protection conductor wiring and contact protection for d	MA ESD assembly	MA ESD assembly and protection conductor wiring	Mechanical 2-stage locking unit	Mechanical 2-stage locking unit with electric motor	MA Safety switch with locking NO (currentless; open)	MA Safety switch with locking NC (currentless; closed)	MA Safety switch without locking	MA Magnetic safety switch	MA Self-opener pneumatic	MA Self-opener electric	Automatic opener/closer	Safety switch	MA Check for pressure frame closed via stroke switch	MA Check for pressure frame closed stroke position by induc	MA Check for pressure frame closed position by inductive se	MA Check ATS locked	MA Locking unit for closed pressure frame stroke magnet NC	MA Locking unit for closed pressure frame stroke magnet NC	MA Locking unit for closed pressure frame pneumatic cylinde	MA Locking unit for pressure frame open	MA Pressure frame unit opening limited	MA Gas pressure springs for the drive unit (kit)	MA Hinged metal handle	MA Pass / fail LED indicator	MA Push button	MA Oil break	MA Anti-pinch protection	MA Extended handle	MA Control unit	MA Magnet control unit	ATS ESD version	ATS Radio frequency version	ATS Dual-stage upgrade kit	ATS Stiffener kit for NDH	ATS Stiffener kit for KTE	ATS Insertion blocker for stroke 22mm	ATS Contact protection for dangerous voltage	ATS Lifting units	ATS Check for pressure frame closed using two GKS	ATS Check for pressure frame closed via stroke switch	ATS Actuator for single-stage	ATS Actuator for dual-stage (basic unit)	ATS Actuator for magnetic sa	ATS Ground plate for ATS	ATS Contacting from above,	ATS Contacting from above,
	5.1	5.2	5.3	5.4	5.5	5.6.1	5.6.2	5.6.3	5.6.4	5.7.1	5.7.2	5.8.1	5.8.2	5.9.1	5.9.2	5.9.3	5.10	5.11.1	5.11.2	5.11.3	5.12	5.13	5.15	5.16	5-17	5.18	5.19	5.20	5.21	5.22	5.23	6.1	6.2	7.1	7.2.1	7.2.2	7.3	7.4	7.5	7.6.1	7.6.2	7.7.1	7.7.2	7.7.3	7.8	7.9.1	7.9.2
	68	68	68	68	68	69	69	69	69	70	70	5	6	70	70	70	71	71	71	71	71	71	72	72	72	72	72	72	73	73	73	36 ff.	37 ff.	73	73	73	74	74	74	74	74	74	75	75	75	75	75
1	⨯	ok	ok	ok	ok	ok	ok	ok	ok	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	NO	ok	ok	XX	XX	ok	NO	ok	ok	ok	ok	Erf.	ok	ok	ok	ok	ok	ok	ok	ok
2	ok	⨯	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	empf	ok	ok	ok	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	Erf.
3	ok	NO	⨯	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	incl.	ok	ok	ok	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	Erf.	ok	ok	ok	ok	ok	ok	ok	Erf.
4	ok	ok	ok	⨯	NO	ok	ok	ok	ok	NO	NO	NO	NO	empf	empf	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	empf	ok	ok	XX	XX	ok	NO	empf	ok	ok	ok	ok	NO	NO	NO	NO	ok	NO	ok	NO	NO
5	ok	ok	ok	NO	⨯	ok	ok	ok	ok	ok	ok	NO	NO	empf	empf	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	empf	ok	ok	XX	XX	ok	NO	empf	ok	ok	ok	ok	NO	NO	NO	NO	ok	NO	ok	NO	NO
6	ok	ok	ok	ok	ok	⨯	NO	NO	XX	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	ok	ok	ok
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11	NO	ok	ok	NO	ok	ok	ok	ok	ok	NO	⨯	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	NO	incl.	ok	ok	incl.	ok	ok	empf	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
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16	70	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	XX	XX	XX	XX	⨯	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	NO	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
17	71	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	⨯	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
18	71	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	NO	NO	ok	ok	ok	ok	⨯	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	NO	empf	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
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23	72	ok	ok	ok	ok	ok	ok	ok	ok	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	⨯	ok	ok	ok	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
24	72	ok	empf	incl.	ok	ok	ok	ok	ok	ok	incl.	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	⨯	ok	ok	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
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26	72	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	⨯	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
27	72	ok	ok	empf	empf	ok	ok	ok	ok	incl.	incl.	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	⨯	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
28	72	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	⨯	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
29	73	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	⨯	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
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31	73	ok	ok	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	empf	ok	XX	ok	XX	XX	XX	XX	XX	XX	XX	XX	XX	⨯	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
32	36 ff.	6.1	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	⨯	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
33	37 ff.	6.2	NO	ok	ok	NO	NO	NO	NO	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	⨯	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
34	73	7.1	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	ok	⨯	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
35	73	7.2.1	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	ok	ok	⨯	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
36	73	7.2.2	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	ok	ok	ok	⨯	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
37	74	7.3	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	NO	ok	ok	ok	⨯	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
38	74	7.4	Erf.	ok	Erf.	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	NO	ok	ok	ok	ok	⨯	ok	ok	ok	ok	ok	ok	ok	ok	ok
39	74	7.5	ok	ok	ok	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	⨯	ok	ok	ok	ok	ok	ok	ok	ok
40	74	7.6.1	ok	ok	ok	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	ok	ok	ok	ok	ok	⨯	XX	ok	ok	ok	ok	ok	ok
41	74	7.6.2	ok	ok	ok	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	empf	XX	ok	ok	ok	ok	ok	ok	ok	ok	XX	⨯	ok	ok	ok	ok	ok	ok
42	74	7.7.1	ok	ok	ok	NO	NO	ok	ok	ok	ok	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	⨯	XX	XX	ok	ok	ok
43	75	7.7.2	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	ok	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	⨯	XX	ok	ok	ok
44	75	7.7.3	ok	ok	ok	NO	NO	XX	XX	XX	XX	empf	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	⨯	ok	ok	ok
45	75	7.8	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	⨯	ok	ok
46	75	7.9.1	ok	ok	ok	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	⨯	ok
47	75	7.9.2	ok	Erf.	Erf.	NO	NO	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	XX	XX	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	⨯

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11 CUSTOMISING GUIDELINES

INGUN customising guidelines feature detailed information about the customisation of devices. The customising guidelines contain information about the complete customisation of a device version and information about the customisation of individual components.

112502, Protective earth wiring and shock-proof protection for dangerous voltages 22
INFO 1073, Rigid pin fixture customising guidelines 18
INFO 112502, Protective earth wiring and shock-proof protection for dangerous voltages 24
INFO 1317, ATS MAxx series customising guidelines..... 13, 53, 54
INFO 2018, Precision customisation with guide plate customising guidelines 16
INFO 2023, Precision customisation with counter bore customising guidelines 16
INFO 2064, Customising guidelines for marking units 16
INFO 2133, ATS MAxxHF RF-Transfer field 53
INFO 4065, ATS MAxx/S-x/KABTEC (inline) customising guidelines 19
INFO 4365, ATS MAxx/CRS IPS19 (inline) customising guidelines 19
INFO 4585, ATS MAxxHF Absorber mats customising guidelines 53
INFO 4586, S-Line customising guidelines..... 18
INFO 4594, Reference design for the control 36, 38
INFO 4595, Assembly Instructions automatic opener/closer 37
INFO 4596, Assembly Instructions safety switch 38

Doku FlyerArt-Nr.: 6125, Customisation & installation documents ATS MA09 series
Doku FlyerArt-Nr.: 6126, Customisation & installation documents ATS MA11 series
Doku FlyerArt-Nr.: 6127, Customisation & installation documents ATS MA12 series
Doku FlyerArt-Nr.: 6128, Customisation & installation documents ATS MA13 series
Doku FlyerArt-Nr.: 6129, Customisation & installation documents ATS MA14 series
Doku FlyerArt-Nr.: 63051, Customisation & installation documents ATS MAxx/HF/AL series

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HUBER+SUHNER Ingun GmbH

Max-Stromeyer-Straße 160
78467 Constance, Germany
Telephone: +49 7531 8105-0
Customer hotline: +49 7531 8105-888
info@ingun.com

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