WOODWARD

High**PRO**TEC-2 | PROTECTION TECHNOLOGY MADE SIMPLE

MRA4-2 | PROTECTION AND CONTROL RELAY FOR FEEDER, GRID AND GENERATOR APPLICATIONS

New Features

- DNP 3.0
- Multiple Communication with One Device
- ANSI Menu Structure
- Page Editor
- IEC 61850 with LC Interface
- Enhanced Security Features

MRA4

APPLICATION

The MRA4 is a high precision and reliable protection and control relay. The intuitive setting concept with plausibility test enables reliable and time optimized configuration of the extensive protection function to a variety of applications such as incoming or outgoing feeder protection, network protection and generator protection.

The implemented switchgear management guaranties an efficient and safe control and supervision.

The device is a bench mark in flexibility and usability and offers various communication options. The hardware is designed for all nominal values in combination with protection and control functionality.

The parameterizing and analyzing software *Smart view SE* is usable for each HighPROTEC device and free of charge.

COMPREHENSIVE PROTECTION PACKAGE [1]

→ Six elements phase overcurrent protection directional and non-directional (ANSI/IEC/51C/51V)
→ Four elements earth fault protection [2] non-directional or directional (multi-polarising)
→ Two elements unbalanced load protection
→ Voltage protection [2] six elements selectable: V<, V>, V<(t)
→ Six elements unbalanced voltage supervision
→ Flexible Fourth Voltage measuring input [2] 2 elements VE> or VX (for synch-check)
→ Synchro-check options Generator-to-System or System-to-System
→ Each of the six elements frequency protection can be used as: f<, f>, ROCOF, vector surge...
→ Six elements power protection each can be used as: P>, P<, Pr, Q>, Q<, Qr, S>, S<
→ Two elements power factor (PF)

POWER QUALITY

→ THD protection

DEMAND MANAGEMENT/ PEAK VALUES

→ Peak values of current and power, average current and energy demand

INTERCONNECTION PACKAGE

The comprehensive interconnection package is summarized within one menu:

→ Non-discriminating active power direction depending load shedding
→ FRT (LVRT): Settable FRT-Profiles, optional AR coordinated
→ QV-Protection: Undervoltage-Reactive Power protection
→ Automatic Reconnection
→ Considerably frequency protection package: Six elements configurable as f<, f>, df/dt (ROCOF), Vector Surge
→ CB-Intertripping
→ Synch Check (Generator to mains, mains-to-mains), options e.g. to switch onto dead bus

SLIDING-MEAN-SQUARE SUPERVISION

→ Adjustable (VDE-AR 4105)

RECORDERS

→ Disturbance recorder: 120 s non volatile
→ Fault recorder: 20 faults
→ Event recorder: 300 events
→ Trend recorder: 4000 non volatile entries

LOGIC

→ Up to 80 logic equations for protection, control and monitoring

TIME SYNCHRONISATION

→ SNTP, IRIG-B00X, Modbus, DNP 3.0, IEC60870-5-103

COMMISSIONING SUPPORT

→ USB connection
→ Customizable Display (Single-Line, ...)
→ Customizable Inserts
→ Copy and compare parameter sets
→ Configuration files are convertible
→ Forcing and disarming of output relays
→ Fault simulator: current and voltage
→ Graphical display of tripping characteristics
→ 8 languages selectable within the relay

COMMUNICATION OPTIONS

→ IEC 61850
→ Profibus DP
→ Modbus RTU and/or Modbus TCP
→ IEC 60870-5-103
→ DNP 3.0 (RTU, TCP, UDP)

IT SECURITY

→ Menu for the activation of BDEW-Whitepaper-compliant security settings (e.g. hardening of interfaces)

CONTROL

→ 1 breaker
→ Breaker wear

PC TOOLS

→ Setting and analyzing software Smart view for free
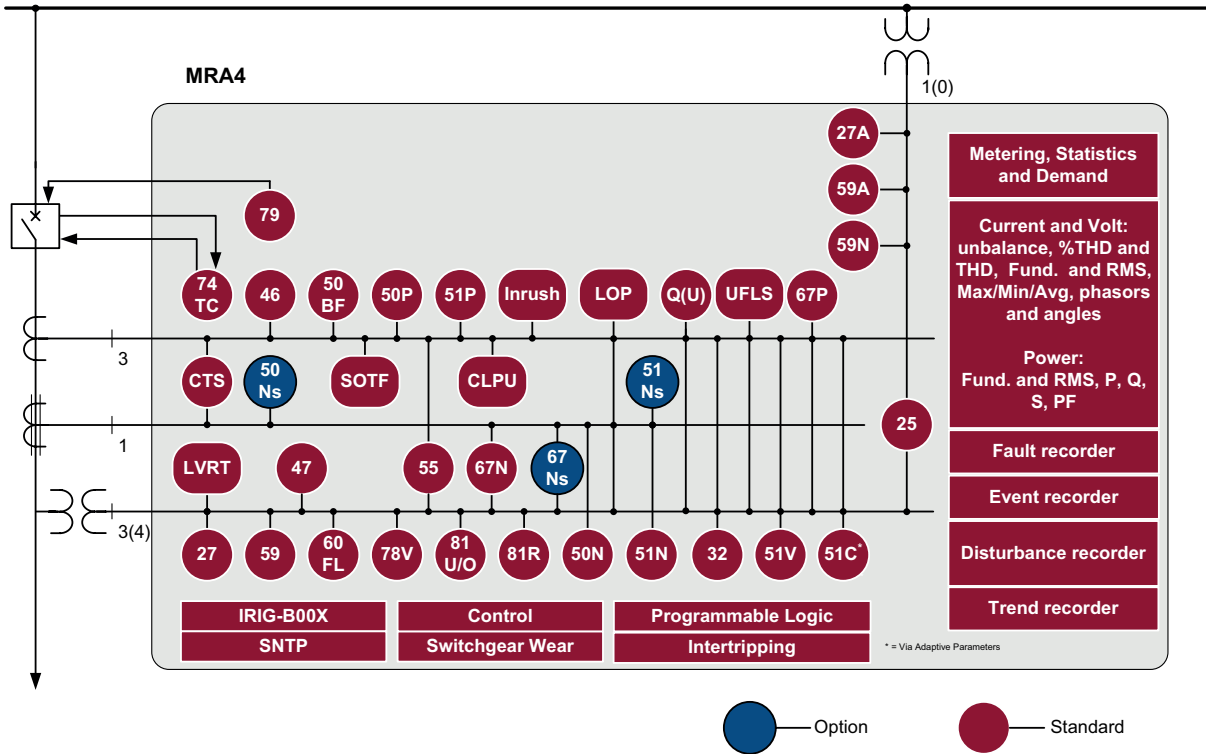→ Including page editor to design own pages

[1] DFT, True RMS or I2 based
[2] DFT or True RMS based

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FUNCTIONAL OVERVIEW

	Elements	ANSI
Protective Functions		
I, time overcurrent and short circuit protection, all elements can be configured for directional or non-directional supervision. Multiple reset options (instantaneous, definite time, reset characteristics according to IEC and ANSI).	6	50P, 51P, 67P
Voltage controlled overcurrent protection by means of adaptive parameters		51C
Voltage dependent overcurrent protection		51V
Negative phase sequence overcurrent protection		51Q
I2>, unbalanced load protection with evaluation of the negative phase sequence currents	2	46
IB, overload protection with thermal replica and separate pick-up values for alarm and trip functions	1	49
IH2/In, inrush detection with evaluation of the 2nd harmonic	1	Inrush
IG, earth overcurrent and short circuit protection, all elements can be configured for directional (multi-polarising) or non-directional supervision. Tremendous reset options (instantaneous, definite time, reset characteristics according to IEC and ANSI).	4	50N, 51N, 67N
V<, V>, V(t)<, under- and overvoltage protection, time dependent undervoltage protection	6	27, 59
Voltage asymmetry supervision (V012) V1, under and overvoltage in positive phase sequence system V2, overvoltage in negative phase sequence system	6	47
Each of the six frequency protection elements can be used as: f< fs, df, dt, ROCOF, DF/DT, vector surge, ...	6	81U/O, 81R, 78
VX, residual voltage protection or bus bar voltage for Synch Check	2	59N
AR, automatic reclosing	1	79
ExP, External alarm and trip functions	4	
PQS, Power protection	6	32, 37
PF, Power factor	2	55
FRT (optional coordination with AR-feature)	27 (t)	27 (t, AR)
Q(V) Protection (undervolt. dep. directional reactive power protection with reclosing disengaging)		
UFLS (non-discriminating active power direction depending load shedding)		
10-Minutes-Mean-Square-Sliding Supervision: adjustable according to VDE-AR 4105		
Synch Check		25

Control and Logic		
Control: Position indication, supervision time management and interlockings for 1 breaker		
Logic: Up to 80 logic equations, each with 4 inputs, selectable logical gates, timers and memory function		

	Elements	ANSI
Supervision Functions		
CBF, circuit breaker failure protection	1	50BF
TCS, trip circuit supervision	1	74TC
LOP, loss of potential	1	60FL
FF, fuse failure protection via digital input	1	60FL
CTS, current transformer supervision	1	60L
CLPU, cold load pickup	1	
SOTF, switch onto fault	1	
Demand management and peak value supervision (current and power)		
THD supervision		
Breaker wear with programmable wear curves		
Recorders: Disturbance recorder, fault recorder, event recorder, trend recorder		

FUNCTIONAL OVERVIEW IN ANSI FORM

MRA4

1(0)

	79						27A	
							59A	
							59N	
74 TC	46	50 BF	50P	51P	Inrush	LOP	Q(U)	UFLS	67P
CTS	50 Ns	SOTF		CLPU		51 Ns		
LVRT	47		55	67N	67 Ns			25
27	59	60 FL	78V	81 U/O	81R	50N	51N	32	51V	51C*

Metering, Statistics and Demand

Current and Volt: unbalance, %THD and THD, Fund. and RMS, Max/Min/Avg, phasors and angles

Power: Fund. and RMS, P, Q, S, PF

Fault recorder

Event recorder

Disturbance recorder

Trend recorder

IRIG-B00X	Control	Programmable Logic
SNTP	Switchgear Wear	Intertripping

* = Via Adaptive Parameters

3

1

3(4)

● — Option   ● — Standard

APPROVALS

CE

(UL) certified regarding UL508 (Industrial Controls)

(CSA) certified regarding CSA-C22.2 No. 14 (Industrial Controls)
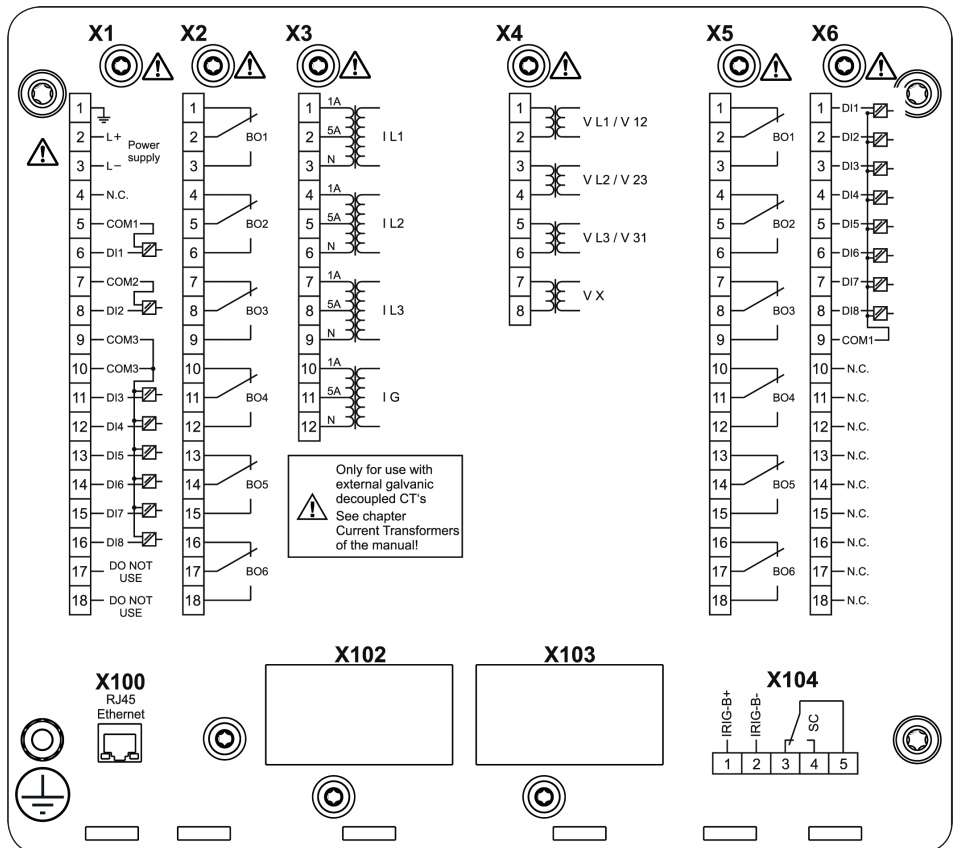
EAC certified by EAC (Eurasian Conformity)

KEMA DNV Type tested (and certified) regarding IEC60255-1

TÜV NORD — TÜV NORD CERT GmbH — Grid Code Compliant — certified regarding „**BDEW**-Richtlinie für Erzeugungsanlagen am Mittel-spannungsnetz, Ausgabe Juni 2008" (German grid code standard)

complies with IEEE 1547-2003 amended by IEEE 1547a-2014

complies with ANSI C37.90-2005

CONNECTIONS *(EXAMPLE)*

X1

1	
2	L + Power supply
3	L –
4	N.C.
5	COM1
6	DI1
7	COM2
8	DI2
9	COM3
10	COM3
11	DI3
12	DI4
13	DI5
14	DI6
15	DI7
16	DI8
17	DO NOT USE
18	DO NOT USE

X2

1	
2	BO1
3	
4	
5	BO2
6	
7	
8	BO3
9	
10	
11	BO4
12	
13	
14	BO5
15	
16	
17	BO6
18	

X3

1	1A	
2	5A	I L1
3	N	
4	1A	
5	5A	I L2
6	N	
7	1A	
8	5A	I L3
9	N	
10	1A	
11	5A	I G
12	N	

Only for use with external galvanic decoupled CT's See chapter Current Transformers of the manual!

X4

1	
2	V L1 / V 12
3	
4	V L2 / V 23
5	
6	V L3 / V 31
7	
8	V X

X5

1	
2	BO1
3	
4	
5	BO2
6	
7	
8	BO3
9	
10	
11	BO4
12	
13	
14	BO5
15	
16	
17	BO6
18	

X6

1	DI1
2	DI2
3	DI3
4	DI4
5	DI5
6	DI6
7	DI7
8	DI8
9	COM1
10	N.C.
11	N.C.
12	N.C.
13	N.C.
14	N.C.
15	N.C.
16	N.C.
17	N.C.
18	N.C.

X100 RJ45 Ethernet

X102

X103

X104

IRIG-B+	IRIG-B-		SC	
1	2	3	4	5

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ORDER FORM MRA4-2

Directional Feeder Protection				MRA4	-2				
Version 2 with USB, enhanced communication and user options									

Digital Inputs	Binary output relays	Housing	Large display						
8	7	B2	-	A					
16	13	B2	-	D					

Hardware variant 2						
Phase Current 5 A/1 A, Ground Current 5 A/1 A				0		
Phase Current 5 A/1 A, Sensitive Ground Current 5 A/1 A				1		

Housing and mounting		
Door mounting		A
Door mounting 19" (flush mounting)		B

Communication protocol	
Without protocol	A
Modbus RTU, IEC60870-5-103, DNP3.0 RTU | *RS485/terminals*	B*
Modbus TCP, DNP3.0 TCP/UDP | *Ethernet 100 MB/RJ45*	C*
Profibus-DP | *optic fiber/ST-connector*	D*
Profibus-DP | *RS485/D-SUB*	E*
Modbus RTU, IEC60870-5-103, DNP3.0 RTU | *optic fiber/ST-connector*	F*
Modbus RTU, IEC60870-5-103, DNP3.0 RTU | *RS485/D-SUB*	G*
IEC61850, Modbus TCP, DNP3.0 TCP/UDP | *Ethernet 100MB/RJ45*	H*
IEC60870-5-103, Modbus RTU, DNP3.0 RTU | *RS485/terminals* Modbus TCP, DNP3.0 TCP/UDP | *Ethernet 100 MB/RJ45*	I*
IEC61850, Modbus TCP, DNP3.0 TCP/UDP | *Optical Ethernet 100MB/LC duplex connector*	K*
Modbus TCP, DNP3.0 TCP/UDP | *Optical Ethernet 100MB/LC duplex connector*	L*
IEC60870-5-103, Modbus RTU, DNP3.0 RTU | *RS485/terminals* IEC61850, Modbus TCP, DNP3.0 TCP/UDP | *Ethernet 100 MB/RJ45*	T*

Harsh Environment Option	
None	A
Conformal Coating	B

Available menu languages (in every device)
English / German / Spanish / Russian / Polish / Portuguese / French / Romanian

* Within every communication option only one communication protocol is usable.
 Smart view can be used in parallel via the Ethernet interface (RJ45).

The parameterizing- and disturbance analyzing software *Smart view* is included in the delivery of HighPROTEC devices.

Current inputs	4 (1 A and 5 A) with automatic CT Disconnect
Voltage inputs	4 (0 … 800 V)
Digital Inputs	Switching thresholds adjustable via software
Power supply	Wide range power supply
	24 V_{DC} – 270 V_{DC} / 48 V_{AC} – 230 V_{AC} (−20/+10%)
Terminals	All terminals plug type
Type of enclosure	IP54
Dimensions of housing	19" flush mounting: 212.7 mm × 173 mm × 208 mm
(W x H x D)	8.374 in. × 6.811 in. × 8.189 in.
	Door mounting 212.7 mm × 183 mm × 208 mm
	8.374 in. × 7.205 in. × 8.189 in.
Weight (max. components)	approx. 4.7 kg / 10.36 lb