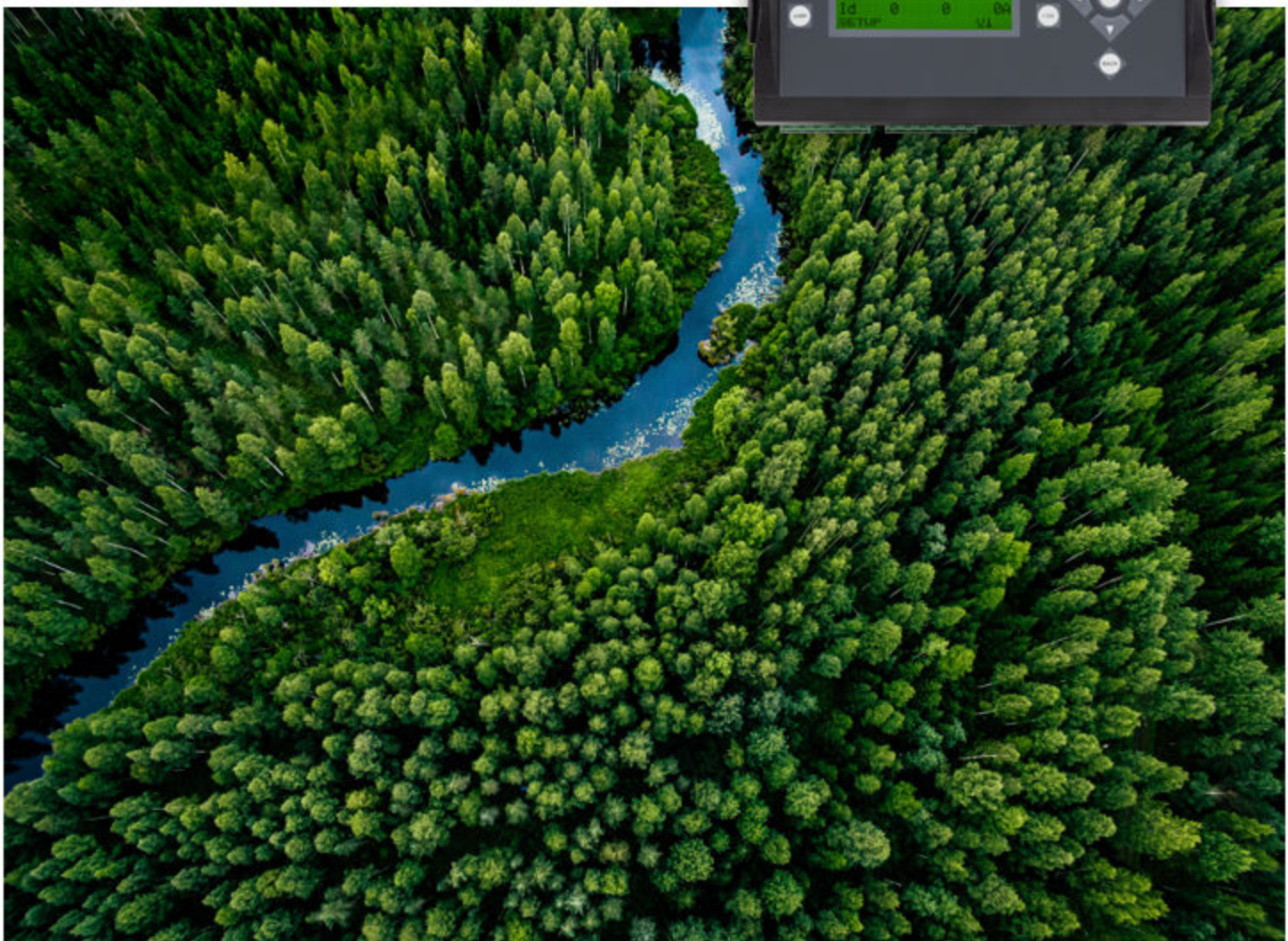


# MDR-2

Multi differential protection relay

Data sheet

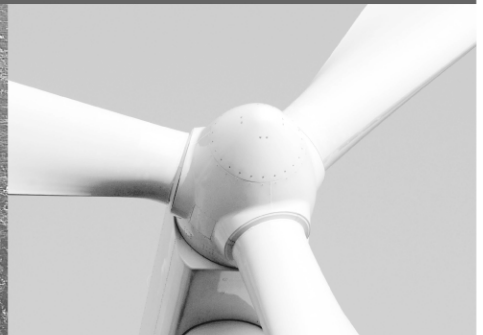




-power in control



## DATA SHEET



### Multi differential protection relay, MDR-2

- Relay for generators/electric motors
- 3-phase AC measurements
- Dynamic compensation for ext. failures
- Short response time (70 ms)
- Display indicating all measurements



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**Application**

The MDR-2 differential protection relay is a micro-processor-based control unit containing all necessary functions for monitoring of the differential currents for a synchronous/asynchronous generator or motor (the object).

Via current transformers the MDR-2 measures each phase current on both sides of the object. The current transformers determine the limits of the protection area. Any failure within these limits (2- or 3-phase short circuits or earth leaks) will be detected as an error  $I_d$ : Differential currents, the currents flowing through the two current transformers of the phase in question differ, and, if a preset limit value is exceeded, a warning will be given or a tripping signal transmitted.

The MDR-2 dynamic compensation curves for warning and tripping are defined by the user.

Should an error occur outside the limits of the protection area, the MDR-2 will not transmit a tripping signal, as the above-mentioned phase currents are equal. In that way a selective protection is achieved.

Except for external measuring transformers the MDR-2 contains all necessary measuring circuits and presents all values on an LC display. Values and messages are presented in clear text (measuring values in engineering units).

The MDR-2 is a flexible and menu/PC-programmed unit, enabling the user to easily adapt the unit to the object in question. The programming procedures are password protected.

**Standard functions**

The unit is designed for differential current protection of a 3-phase generator/motor.

Inputs and outputs:

Inputs: - 6 currents via current transformers  
 - 2 binary control inputs

Outputs: - 6 relay outputs  
 ("SYSTEM OK", 5 configurable relays)

Generator protective functions:

- Differential current (3-phase) protection, with programmable dynamic compensation (pickup curves)
- Warning: Programmable value and delay
- Trip: Programmable value and delay

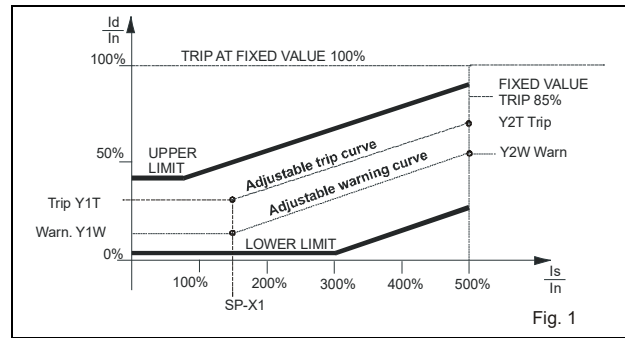


Fig. 1

A pickup curve is shown in Fig. 1. The curves represent the warning and tripping values ( $I_d/I_n=Y$ ), defined as the differential current ( $I_d$ ) divided by the nominal generator/motor current ( $I_n$ ) referring to the stabilisation current ( $I_s$ ) divided by  $I_n$  ( $I_s/I_n=X$ ).

The starting horizontal limit lines are placed according to the keyed in values of the points P(X1, Y1T) and P(X1, Y2T). These can be positioned anywhere within the marked area and must be decided according to the specifications of the plant in question.

For warning and tripping pickup curves the following ranges are available:

- $I_d/I_n > 100 \%$  Fixed tripping point  
Independent of the stabilisation current
- $I_s/I_n > 500 \%$  Fixed tripping ( $I_d/I_n > 85 \%$ )  
Fixed warning (Y2W)
- $I_s/I_n < 500 \%$  Trip and warning programmable within "UPPER LIMIT" and "LOWER LIMIT" values and dependent on the  $I_s/I_n$  value

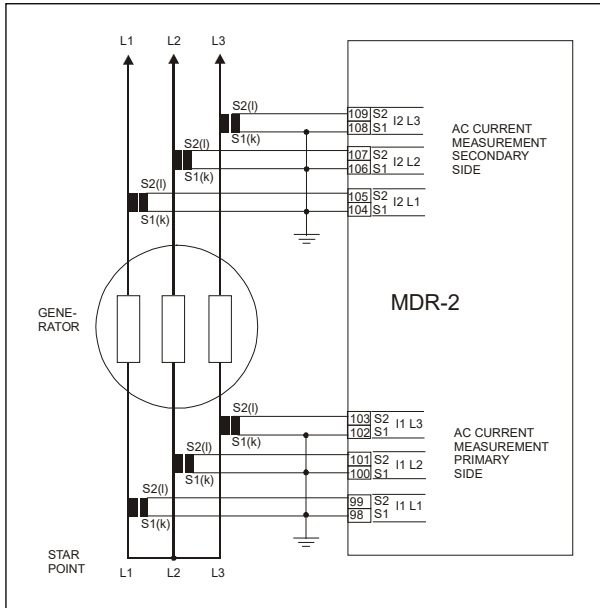
Display of values and texts:

- LEDs: Supervision, alarm
- Alarm and condition indication in clear text on LC display
- AC values (differential and actual currents for all three phases) on LC display

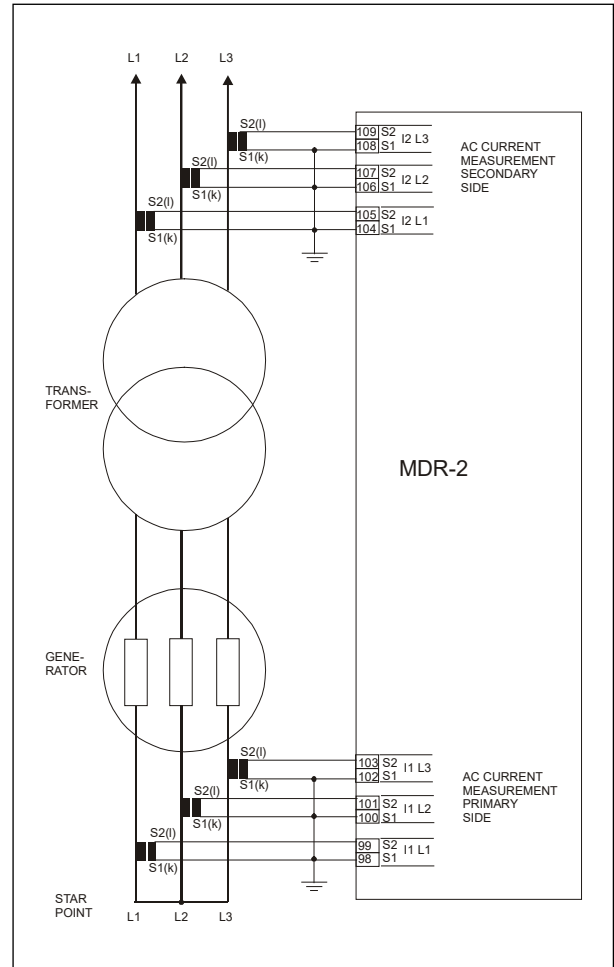
Acknowledgement of alarms:

- Automatic acknowledgement YES/NO (programmable)
- Remote acknowledgement via push-button input
- Local acknowledgement via display front push-button

Principle diagram



Principle diagram, option C4



Available variants

| Type  | Variant no. | Description                          | Item no.      | Note |
|-------|-------------|--------------------------------------|---------------|------|
| MDR-2 | 01          | MDR-2 with display and display cable | 2912500020-01 |      |
| MDR-2 | 04          | MDR-2 without display                | 2912500020-04 |      |

Available options

| Option   | Description   | Slot no. | Option type | Note |
|----------|---|----------|-------------|------|
| <b>C</b> | <b>Generator add-on protection package</b>  |          |             |      |
| C3       | <p><u>Over-current/short circuit protection (option C3):</u></p> <ul style="list-style-type: none"> <li>- 2 x definite time or inverse time (curve with six programmable points) over-current protection (400 % over-current max.)</li> <li>- 1 x definite time short circuit protection (500 % short circuit current max.)</li> </ul>  |          | Software    |      |
| C4       | <p><u>Block differential current protection (option C4):</u></p> <p>The block differential protection option protects a generator and a step-up transformer (a block) together.</p> <p>The option handles the following:</p> <ul style="list-style-type: none"> <li>- Step-up transformer ratio</li> <li>- Different CT ratios on generator and on high voltage (HV) side of the step-up transformer</li> <li>- Step-up transformer inrush current (2<sup>nd</sup> harmonic)</li> <li>- Step-up transformer overexcitation current (5<sup>th</sup> harmonic)</li> <li>- Step-up transformer phase angle shift from primary to secondary side. The following winding connections are supported:                             <ul style="list-style-type: none"> <li>• Dd 0, phase angle shift 0 deg.</li> <li>• Dd 6, phase angle shift 180 deg.</li> <li>• Dy 1, phase angle shift -30 deg.</li> <li>• Dy 5, phase angle shift -150 deg.</li> <li>• Dy 7, phase angle shift 150 deg.</li> <li>• Dy 11, phase angle shift 30 deg.</li> <li>• Yd 1, phase angle shift -30 deg.</li> <li>• Yd 5, phase angle shift -150 deg.</li> <li>• Yd 7, phase angle shift 150 deg.</li> <li>• Yd 11, phase angle shift 30 deg.</li> </ul> </li> </ul> |          | Software    |      |

Available accessories

| Accessory                          | Description   | Item no.   | Note |
|------------------------------------|---|------------|------|
| <b>Operator panels</b>             |   |            |      |
| Standard Display Unit, DU-2        | For connection directly to base unit with display cable | 2912210050 |      |
| Display gasket for IP54 (L)        | Standard is IP40  | 1134510010 |      |
| <b>Cables</b>                      |   |            |      |
| Display cable, 3 m (J1)            |   | 1022040076 |      |
| Display cable, 6 m (J2)            |   | 1022040057 |      |
| RS-232 serial interface cable (J3) | For PC utility software                                 | 1022040044 |      |
| Display cable, 1 m (J6)            |   | 1022040064 |      |
| <b>Documentation</b>               |   |            |      |
| Designer's Reference Handbook (K1) |   | 4189340583 |      |

**Technical specifications**

|  |  |
|--|--|
| <p><b>Accuracy:</b> For <math>I &gt; 0.05 \times I_N</math> at rated frequency:</p> <p><b>For <math>I_N = 1 \text{ A}</math></b><br/> <math>I \leq I_N</math>: 1 % of <math>I_N</math><br/> <math>I_N &lt; I</math>: 1 % of <math>I</math></p> <p><b>For <math>I_N = 5 \text{ A}</math></b><br/> <math>I \leq I_N</math>: 1 % of <math>I_N</math><br/> <math>I_N &lt; I \leq 3 \times I_N</math>: 1 % of <math>I</math></p> <p>(<math>I</math> = measured value)</p> <p><b>Measurement range</b><br/> <math>I_1</math> &amp; <math>I_2</math>: 0.03 to <math>6 \times I_N</math></p>   | <p><b>Safety:</b> To EN 61010-1. Installation cat. III, 600 V. Pollution degree 2</p> <p>To UL 508 and CSA 22.2 no. 14-05, over-voltage category III, 300 V, pollution degree 2</p> <p><b>Galv. separation:</b> Between AC inputs and others: 3250 V AC – 50 Hz – 1 min.</p> <p><b>EMC/CE:</b> To EN 61000-1/2/3/4 and IEC 255-3</p> <p><b>Connections:</b> Current: Max. 4 mm<sup>2</sup> (multi-stranded) 6 mm<sup>2</sup> (single-stranded)<br/>         (UL/cUL Listed: AWG28-10)<br/>         Tightening torque: 0.5 to 0.6 Nm (4.4 to 5.3 lb-in)<br/>         Others: Max. 2.5 mm<sup>2</sup> (multi-stranded)<br/>         (UL/cUL Listed: AWG28-12)<br/>         Tightening torque: 0.5 to 0.6 Nm (4.4 to 5.3 lb-in)<br/>         Display: 9-pin SUB-D (female)<br/>         Service port: 9-pin SUB-D (male)</p> <p><b>Protection:</b> Terminals: IP20<br/>         Display front: IP40 (IP54 with gasket)<br/>         (UL/cUL Listed: Type Complete Device, Open Type)<br/>         According to IEC 529 and EN 60529</p> <p><b>Material:</b> All plastic parts are self-extinguishing to UL 94 (V1)</p> <p><b>Approval:</b> The MDR-2 is approved by the major classification societies. Contact DEIF for details<br/>         UL and cUL</p> <p><b>UL markings:</b> Wiring: Use 60/75 °C copper conductors only<br/>         Mounting: For use on a flat surface of type 1 enclosure<br/>         Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)</p> |
| <p><b>Operating temp.:</b> -25 to 70 °C (-13 to 158 °F)<br/>         (UL/cUL Listed: Max. surrounding air temp.: 55 °C/131 °F)</p> <p><b>Climate:</b> Class HSE, to DIN 40040</p> <p><b>Meas. frequency:</b> 30 to 70 Hz<br/>         Rated frequency: 50 Hz or 60 Hz</p> <p><b>Aux. supply:</b> 12/24 V DC nominal (8 to 36 V DC operational), max. 11 W consumption<br/>         0 V DC for 10 ms when coming from at least 24 V DC<br/>         The aux. supply inputs are to be protected by a 2 A slow blow fuse<br/>         (UL/cUL Listed: AWG 24)</p> <p><b>Binary inputs:</b> Input voltage: 6 to 32 V DC (bi-directional)<br/>         Input impedance: Max. 2.4 kΩ</p> <p><b>Meas. current:</b> -/1 A or -/5 A (option C4 -/1 A only)<br/>         (UL/cUL Listed: From CTs 1-5 A)<br/>         Consumption: Max. 0.3 VA per phase</p> <p><b>Over-current:</b> 4 × <math>I_N</math>, continuously<br/>         20 × <math>I_N</math>, 10 sec. (max. 75 A)<br/>         80 × <math>I_N</math>, 1 sec. (max. 300 A)</p> <p><b>Response times:</b><br/>         (Delay set to minimum)<br/>         Differential current: 70 ms<br/>         Block diff. current (option): 120 ms<br/>         Over-current (option): 90 ms<br/>         Short circuit (option): 70 ms</p> <p><b>Relay outputs:</b> Contact rating: 5 A/250 V AC ("Status": 1 A)<br/>         (UL/cUL Listed: 250 V AC/24 V DC, 2 A resistive load)</p> |  |

**Mounting and dimensions**

**Mounting of the unit**

The unit is designed for mounting inside the panel. The display can be installed on the panel door and connected to the main unit with a display cable.

The unit is primarily used in marine applications and must be mounted with screws to the rear side of the cabinet. Six screw holes are available for this mounting method.

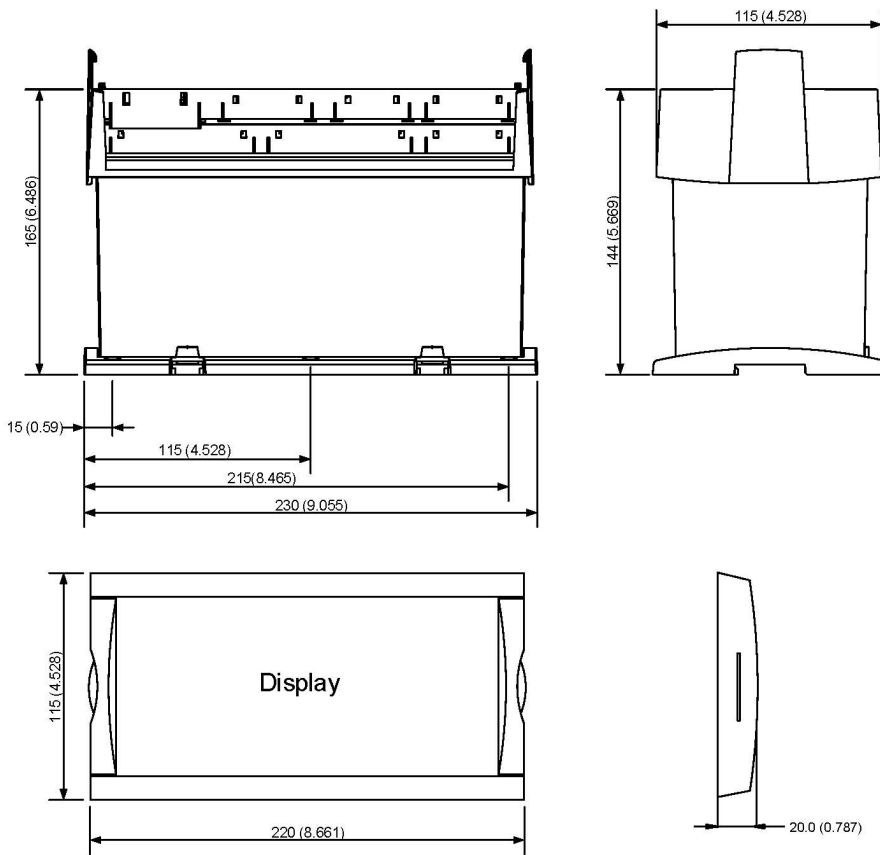


**DEIF recommends using the screw hole fastening.**



**Do not use chemicals or oils (cutting oil, lubricating oil/grease) on or near the surfaces of the controller housing or display panel. These may cause serious damage to the plastic parts and render the warranty void.**

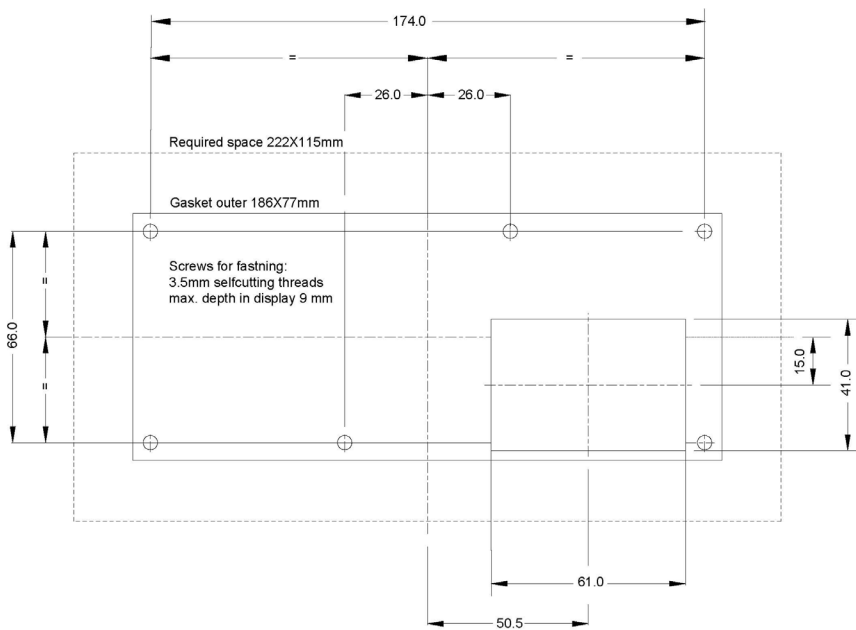
**Unit dimensions**



**Dimensions are given in mm (inches).**

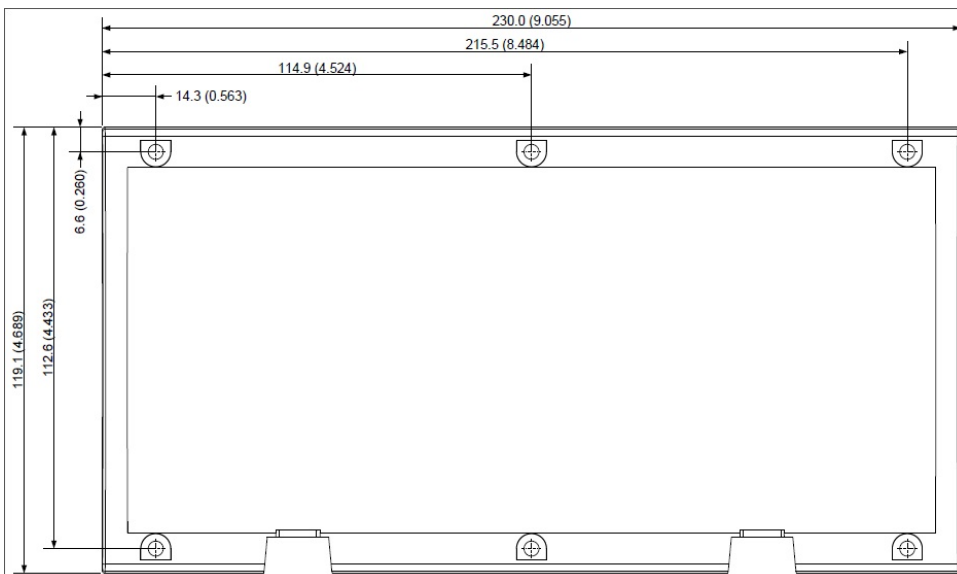
**Panel cutout**

In order to ensure optimum mounting, the panel door must be cut out according to the panel cutout illustration.



Dimensions are given in mm.

**Drilling template in mm (inches)**



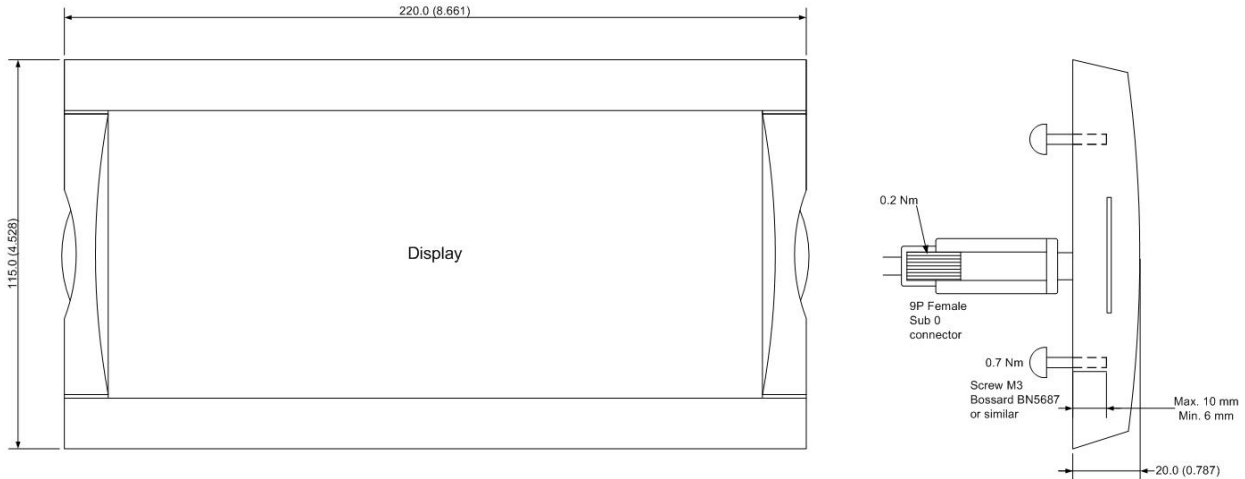


# Data sheet

# Multi differential protection relay, MDR-2

## Tightening torques

- Controller unit: 1.5 Nm for the six M4 screws (countersunk screws are not to be used)
- Unit panel door mounting: 0.3 Nm, 2.7 lb-in (see diagram in "Unit dimensions")
- Plug connections (terminals): 0.5 Nm, 4.4 lb-in
- Display (see diagram below)
- Panel door mounting: 0.7 Nm, 6.2 lb-in
- Sub-D screw: 0.2 Nm, 1.8 lb-in



## Order specifications

### Variants

| Mandatory information |      |             | Additional options to the standard variant |        |        |        |        |        |
|-----------------------|------|-------------|--|--------|--------|--------|--------|--------|
| Item no.              | Type | Variant no. | Option                                     | Option | Option | Option | Option | Option |
|                       |      |             |  |        |        |        |        |        |

Example:

| Mandatory information |       |             | Additional options to the standard variant |        |        |        |        |        |
|-----------------------|-------|-------------|--|--------|--------|--------|--------|--------|
| Item no.              | Type  | Variant no. | Option                                     | Option | Option | Option | Option | Option |
| 2912500020-01         | MDR-2 | 01          | C4   |        |        |        |        |        |

### Accessories

| Mandatory information |      |           |
|-----------------------|------|-----------|
| Item no.              | Type | Accessory |
|                       |      |           |

Example:

| Mandatory information |                       |                         |
|-----------------------|-----------------------|-------------------------|
| Item no.              | Type                  | Accessory               |
| 1022040076            | Accessories for MDR-2 | Display cable, 3 m (J1) |

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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