
Relion® 605 series

# Self-Powered Feeder Protection REJ603 Product Guide

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ABB

# Contents

# 1. Description

The feeder protection relay REJ603 is part of the feeder protection series of relays, intended for the protection of secondary distribution network in utilities and industries.

The feeder protection relay REJ603 is designed to be an integral part of the most popular Safering Ring Main Unit (RMU) and Safeplus compact switchgear. The REJ603 relay is a self-powered numerical relay, which derives power from the main current transformers. This way REJ603 relay ensures complete installation protection even without an auxiliary supply and hence is suitable for unmanned distribution substations having no auxiliary services.

# 2. Protection Functions

The relay principally offers three phase non-directional overcurrent (low-set and high-set stage) and non-directional earth-fault protection (low-set and high-set stage).

**Protection Functions of REJ603**

| Protection | IEC | ANSI |
|---|---|---|
| Three phase overcurrent protection, low-set stage | 3I> | 51 |
| Three phase overcurrent protection, high-set stage | 3I>> | 50 / 51 |
| Earth-fault protection, low-set stage | $I_0$> | 51N |
| Earth-fault protection, high-set stage | $I_0$>> | 50N / 51N |
| Three phase transformer inrush detector | $3I_{2f}$> | 68 |

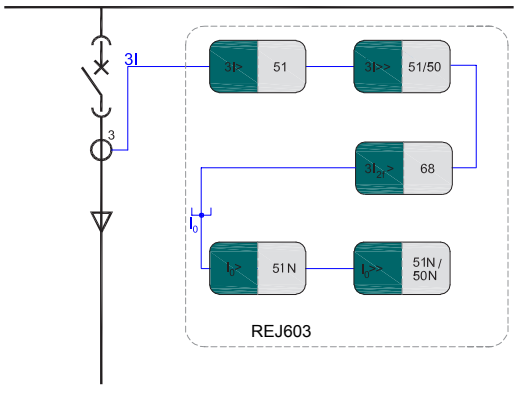



*Fig. 1. Protection overview of Self-powered feeder protection REJ603 with earth current measurement by internal* calculation

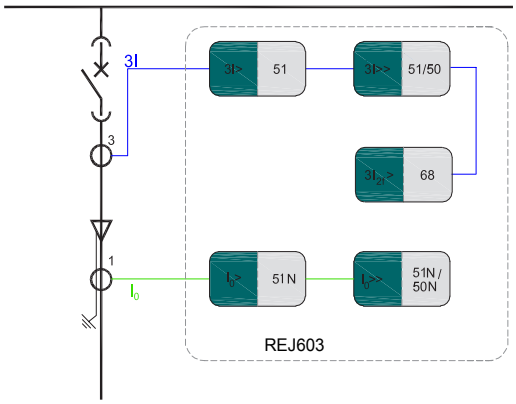



*Fig. 2. Protection overview of Self-powered feeder protection REJ603 with earth current measurement by external CBCT*

## 3. Application

REJ603 is intended to be used for the selective short-circuit and earth-fault protection of feeders in secondary distribution networks and for protection of transformers in utilities and industries. The relay is a self-powered Numerical relay, which does not require an external auxiliary supply voltage, making it an ideal choice for installation even in remote locations where auxiliary supplies are not available. The relay derives power for its operation from the current transformers. REJ603 is primarily used in Ring Main Units (RMU) within distribution network.

Relay provides earth current measurement through internal calculation or has the provision for measuring it from the external core balance current transformer (CBCT).

## 4. Self-supervision

The relay's built-in self-supervision system continuously monitors the state of the relay hardware and the operation of the relay software. When a relay fault is detected, the IRF LED will glow red. In the event of a critical relay failure, all the protection functions of the relay will be completely blocked to prevent any incorrect relay operation.

Additionally, the relay offers fail safe trip in the combined event of critical internal relay failure and phase currents exceeding twenty times the maximum nominal current value.

## 5. Inputs and outputs

- Three CT inputs for phase current and internally calculated earth-fault measure ment
- One core balance current transformer (CBCT) input for earth fault measurement
- One binary input for remote trip
- One impulse output for low energy trip coil

## 6. Testing

The special CT's for REJ603 have a test winding to simulate primary current for testing of complete protection scheme including primary CT, relay, and trip coil.

## 7. LED and flag indications

- Ready LED
- IRF LED
- Trip Flag: Built-in hand-reset electromechanical flag for overcurrent or earth-fault trip indication
- Reset pushbutton for trip flag

## 8. Optional HMI

As a primary user interface, the REJ603 has DIP switches, few LEDs and a electromechanical flag for trip indication. Although this interface is sufficient for basic self-powered protection applications, certain installations may require a interface like conventional auxilary powered relays. Such requirement can be fullfilled with the optional battery powered HMI (Human Machine Interface) which features a unique touch screen display. The available functionality with HMI, includes segregatted trip indication, events with time stamp, fault record, display of primary values, fault codes etc., which help in post fault analysis. The HMI also overcomes the limitation of setting resolution posed by DIP switches and allows finer settings as well as setting of additional parameters.

# 9. Technical data

**Dimensions**

| | |
|---|---|
| Width | 96 mm |
| Height | 160 mm |
| Depth | 149 mm (w/o HMI),<br>150 mm (with HMI) |

**Energizing Inputs**

| | | |
|---|---|---|
| Rated Frequency | | 50/60 Hz ± 5 Hz |
| Phase inputs | Nominal primary current | |
| | CT type | Rated CT current range $I_s$ ($I_{smin}$ - $I_{smax}$) |
| | REJ603-CT1 | 8 - 28 A |
| | REJ603-CT2 | 16 - 56 A |
| | REJ603-CT3 | 32 - 112 A |
| | REJ603-CT4 | 64 - 224 A |
| | REJ603-CT5 | 128 - 448 A |
| | Thermal withstand capability<br>• Continuously<br>• For 1 s<br>• For 3 s | <br>2.5 x $I_{smax}$<br>25 kA primary current<br>20 kA primary current |
| | Dynamic current withstand:<br>• Half-wave value | <br>62.5 kA primary current |
| Earth input | Rated current, $I_n$ | 1 A |
| | Thermal withstand capability<br>• Continuously<br>• For 1 s | <br>4 A<br>100 A |
| | Dynamic current withstand:<br>• Half-wave value | <br>250 A |
| | Input impedance | < 100 mΩ |

**Binary inputs**

| | |
|---|---|
| Rated voltage | 24 - 240 V AC/DC |
| Operating range | -15%…+10% for AC , -30% … +20% for DC |
| Current drain | 2...15 mA |
| Power consumption | < 0.8 W |
| Threshold voltage | 13 V AC/17 V DC |

**Impulse voltage trip output**

| | |
|---|---|
| Rated output voltage | 12 V |
| Pulse time | 30 ms |
| Energy | 50 mJ |

## Setting range and accuracy

| **Setting range of nominal current $I_s$** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REJ603-CT1 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 20 | 22 | 24 | 26 | 28 |
| REJ603-CT2 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 40 | 44 | 48 | 52 | 56 |
| REJ603-CT3 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 64 | 68 | 72 | 80 | 88 | 96 | 104 | 112 |
| REJ603-CT4 | 64 | 72 | 80 | 88 | 96 | 104 | 112 | 120 | 128 | 136 | 144 | 160 | 176 | 192 | 208 | 224 |
| REJ603-CT5 | 128 | 144 | 160 | 176 | 192 | 208 | 224 | 240 | 256 | 272 | 288 | 320 | 352 | 384 | 416 | 448 |

| **Low-set phase over-current protection stage I>** | |
|---|---|
| Measuring range | 0.9 x $I_{smin}$ ...20 x $I_{smax}$ |
| Setting range of pick-up current I> | 0.9...2.5 x $I_s$ |
| Setting resolution/steps | $I_s$ x 0.9...2.5 (31 steps), exit |
| Accuracy of pick-up current | ±5% of set value in the temperature range 0...70ºC<br>±7.5% of set value in the temperature range -40...85ºC |
| Setting range of definite time delay t> | 0.05...3.0 sec |
| Setting resolution/steps | 0.05, 0.07, 0.1, 0.15, 0.2, 0.25, 0.3, 0.4, 0.6, 0.8, 1.0, 1.4, 1.8, 2.2, 2.6, 3.0 |
| Accuracy of operate time | ±1% or 10 ms, whichever is greater |
| Setting of inverse time characteristics | **IEC 255-3:**<br>Normal Inverse, Very Inverse,<br>Extremely Inverse, Long time Inverse<br>**Special Curves:**<br>RI Inverse Time, HR-Fuse, FR-Fuse |
| Setting range of time multiplier k | 0.05...3.0 |
| Setting resolution/steps | 0.05, 0.07, 0.1, 0.15, 0.2, 0.25, 0.3, 0.4, 0.6, 0.8, 1.0, 1.4, 1.8, 2.2, 2.6, 3.0 |
| Accuracy of operate time<br>IEC characteristics<br>RI characteristics<br>HR, FR curve characteristics | <br>class E(5) or ±35 ms, whichever is greater<br>As per NI(IEC) curve<br>±20% of set value or ±35 ms, whichever is greater |

| **High-set phase overcurrent protection stage I>>** | |
|---|---|
| Setting range of pick-up current I>> | 1...20 x $I_s$ |
| Setting resolution/steps | $I_s$ x 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14,16, 18, 20, exit |
| Accuracy of pick-up current | ±5% of set value in the temperature range 0...70ºC<br>±7.5% of set value in the temperature range -40...85ºC |
| Setting range of definite time delay t>> | 0.04...3.0 sec |
| Setting resolution/steps | 0.04, 0.07, 0.1, 0.15, 0.2, 0.25, 0.3, 0.4, 0.6, 0.8, 1.0, 1.4, 1.8, 2.2, 2.6, 3.0 |
| Accuracy of Operate time | ±1% or 10 ms, whichever is greater |

*(continued)*

| | |
|---|---|
| **Low-set earth-fault protection stage $I_0$>** | |
| Nominal value of earth current<br>• Internal measurement<br>• External measurement | <br>$I_s$<br>$I_n$: 1 A |
| Measurement range | 0.9 x $I_{smin}$ ...20 x $I_{smax}$ / 0.1...20 x $I_n$ |
| Setting range of pick-up current $I_0$> | 0.1...1 x $I_s$ / 0.1 - 1 x $I_n$ |
| Setting resolution/steps | $I_s$ or $I_n$ x 0.1…1.0 (31 steps), exit |
| Accuracy of pick-up current<br>Internal measurement<br><br>External measurement | <br>±3% of $I_s$ in the temperature range 0...70ºC<br>±7.5% of $I_s$ in the temperature range -40...85ºC<br>±5% of $I_n$ in the temperature range 0...70ºC<br>±20% of $I_n$ in the temperature range -40...85ºC |
| Setting range of definite time delay $t_0$> | 0.05...3.0 sec |
| Setting resolution/steps | 0.05, 0.07, 0.1, 0.15, 0.2, 0.25, 0.3, 0.4, 0.6, 0.8, 1.0, 1.4, 1.8, 2.2, 2.6, 3.0 |
| Accuracy of operate time | ±1% or 10 ms, whichever is greater |
| Setting of inverse time characteristics | **IEC 255-3:**<br>Normal Inverse, Very Inverse<br>Extremely Inverse, Long time Inverse<br>**Special Curves:**<br>RI Inverse Time, HR-Fuse, FR-Fuse |
| Setting range of time multiplier $k_0$ | 0.05…3.0 |
| Setting resolution/steps | 0.05, 0.07, 0.1, 0.15, 0.2, 0.25, 0.3, 0.4, 0.6, 0.8, 1.0, 1.4, 1.8, 2.2, 2.6, 3.0 |
| Accuracy of operate time<br>IEC characteristics<br>RI characteristics<br>HR, FR curve characteristics | <br>class E(5) or ±35 ms, whichever is greater<br>As per NI(IEC) curve<br>±20% of set value or ±35 ms, whichever is greater |
| **High-set earth-fault protection stage $I_0$>>** | |
| Setting range of pick-up current $I_0$>> | 1...20 x $I_s$ / 1...20 x $I_n$ |
| Setting resolution/steps | $I_s$ or $I_n$ x 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14,16, 18, 20, exit |
| Accuracy of pick-up current<br>Internal measurement<br><br>External measurement | <br>±3% of set value in the temperature range 0...70ºC<br>±7.5% of set value in the temperature range -40...85ºC<br>±5% of set value in the temperature range 0...70ºC<br>±15% of set value in the temperature range -40...85ºC |
| Setting range of definite time delay $t_0$>> | 0.04...3.0 sec |
| Setting resolution/steps | 0.04, 0.07, 0.1, 0.15, 0.2, 0.25, 0.3, 0.4, 0.6, 0.8, 1.0, 1.4, 1.8, 2.2, 2.6, 3.0 |
| Accuracy of operate time | ±1% or 10 ms, whichever is greater |

**Degree of protection by enclosure**

| | |
|---|---|
| Front portion with cover | IP 54 |
| Side with connection terminals | IP 20 |

**Environmental conditions and tests**

| **Environmental conditions** | |
|---|---|
| Service temperature range | -25...+85ºC (relay without HMI)<br>-25...+70ºC (relay with HMI) |
| Relative humidity | < 93% |
| Atmospheric pressure | 86...106 kPa |
| Altitude | up to 2000 m |
| Transport and storage temperature range | -40...+85ºC |
| **Environmental tests** | |
| Dry heat test | According to IEC 60068-2-2<br>Test values:<br>• 16 h at +70ºC<br>• 96 h at +85ºC |
| Dry cold test | According to IEC 60068-2-1<br>Test values:<br>• 16 h at -25ºC<br>• 96 h at -40ºC |
| Damp heat test, cyclic | According to IEC 60068-2-30<br>Test values:<br>• 2 cycles at +25...55ºC<br>humidity 95...97% |
| Damp heat test, steady state | According to IEC 60068-2-78<br>Test values:<br>• 96 h at +40ºC<br>humidity 94% |
| Storage test | According to IEC 60068-2-48<br>Test values:<br>• 96 h at +85ºC<br>• 96 h at -40ºC |

**Electromagnetic compatibility tests**

| The EMC immunity test level meets the requirements listed below: | |
|---|---|
| 1 MHz burst disturbance test<br><br>• Common mode<br>• Differential mode | According to IEC 61000-4-12 and IEC 60255-22-1<br>2.0KV, 1MHz, 400 pulses/sec<br>1.0KV, 1MHz, 400 pulses/sec |
| Electrostatic discharge test<br><br>• Contact discharge<br>• Air discharge | According to IEC 60255-22-2, class III,<br>6kV, 150 pF/330 Ω<br>8kV, 150 pF/330 Ω |
| Radiated, electro-magnetic field immunity test | According to IEC 60255-22-3, level III,<br>Test values: 10 V/m,<br>f = 80…1000 MHz |

*(continued)*

| | |
|---|---|
| Electrical fast transient disturbance test | According to IEC 60255-22-4, class A, 4 kV, 2.5 kHz |
| Surge immunity test<br><br>• Common mode<br>• Differential mode | According to IEC 60255-22-5, and IEC 61000-4-5<br>1 kV, 1.2/50 µs, $R_s$=42 Ω<br>0.5 kV, 1.2/50 µs, $R_s$=42 Ω |
| Immunity to conducted disturbances induced by radio frequency fields | According to IEC 60255-22-6, level III,<br>Test values:<br>10V, f=150 KHz…80 MHz<br>27MHz and 68 MHz (spot freq.) |
| Conducted and radiated radio-frequency emission tests<br><br>• Conducted emission (mains)<br><br>• Radiated emission | According to IEC 60255-25, EN550 11-CISPR II<br>Frequency range: 30-230 MHz,<br>Limits dB(µV/m):40<br>Frequency range: 230-1000 MHz,<br>Limits dB(µV/m):47 |
| Power frequency magnetic field immunity test<br>• Continuous<br>• Short duration (10 s) | According to IEC 61000-4-8<br>• level V, 100 A/m<br>• 300 A/m |
| Pulse magnetic field immunity test | According to IEC 61000-4-9, 1000 A/m, 6.4/16 µs Tr/Th |

**Insulation and mechanical tests**

| **Insulation tests** | |
|---|---|
| Dielectric test | According to IEC 60255-5,<br>Test values:<br>2 KV, 50 HZ for 1 min. |
| Impulse voltage test | According to IEC 60255-5,<br>Test values:<br>5 kV, 1.2/50 µs, 0.5 J |
| Insulation resistance test | >100 M Ω at 500 V DC |

| **Mechanical tests** | |
|---|---|
| Vibration tests<br><br>• Response<br><br>• Endurance | According to IEC 60255-21-1, class 1,<br>Test values<br>10...150 Hz, 0.035 mm/0.5 g,<br>1 sweep/axis<br>10...150 Hz, 1 g, 20 sweeps/axis |
| Shock test<br><br>• Response<br>• Withstand | According to IEC60255-21-2, class 2,<br>10 g, 3 pulses in each direction<br>30 g, 3 pulses in each direction |
| Bump test | According to IEC60255-21-2, class 2,<br>20 g, 1000 bumps in each direction |

# 10. Connection and terminal diagram

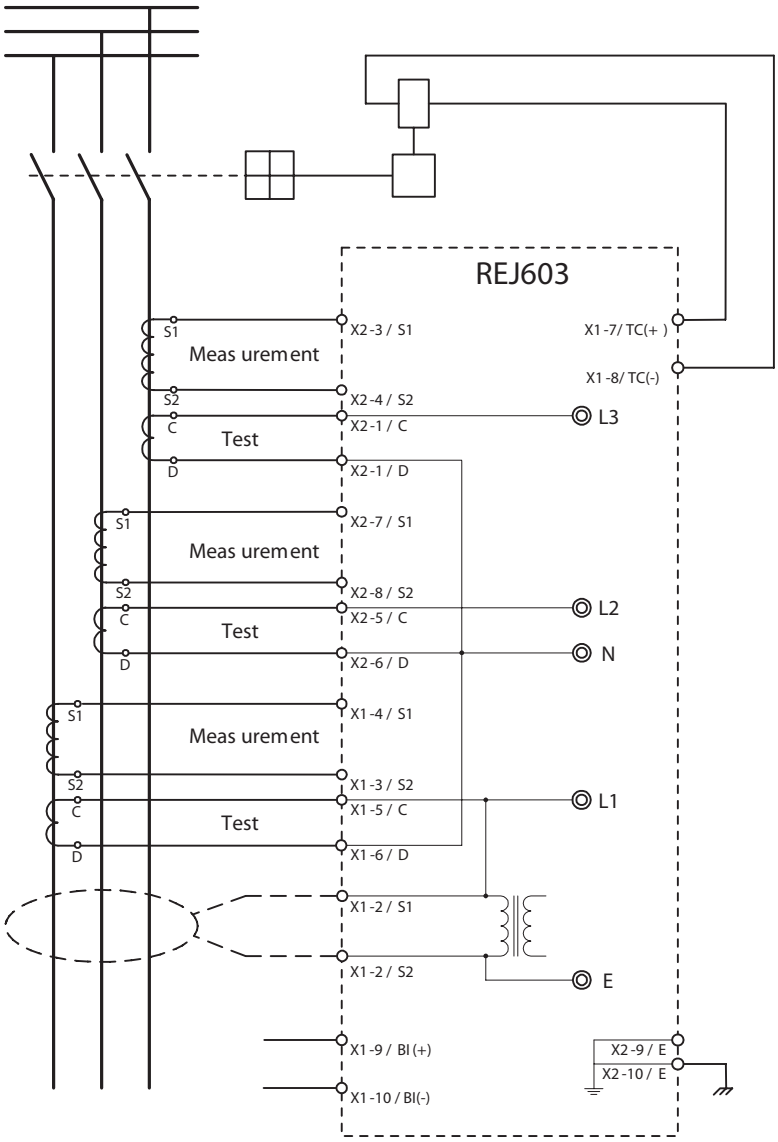



*Fig. 3. Connection diagram of Self-powered feeder protection REJ603*

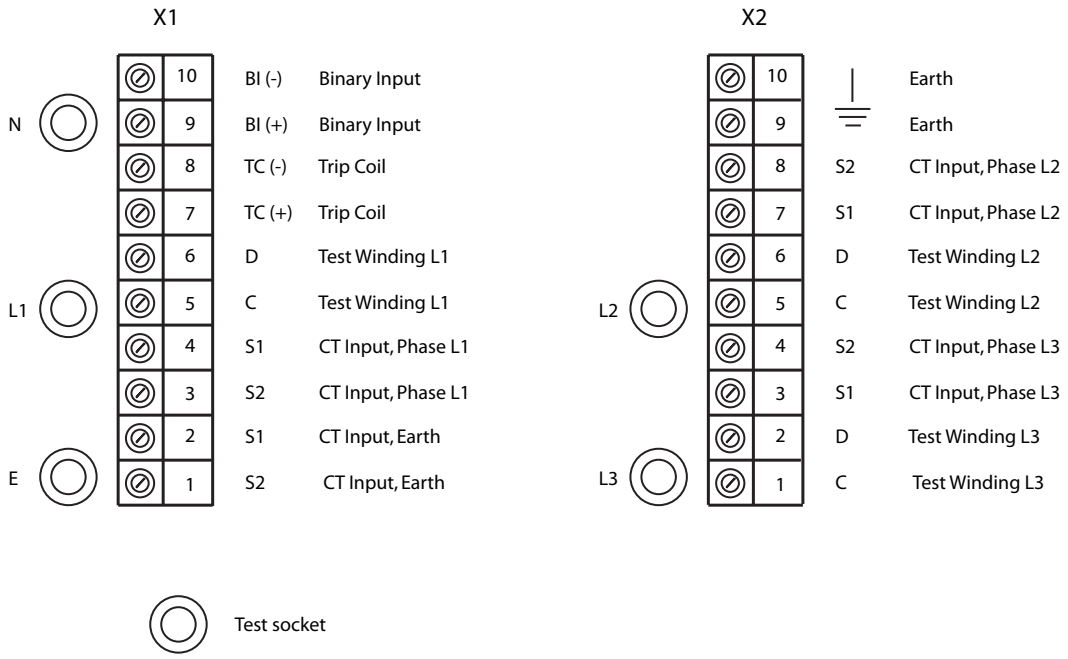



*Fig. 4. Terminal arrangement of Self-powered feeder protection REJ603*

# 11. Dimensions and mounting

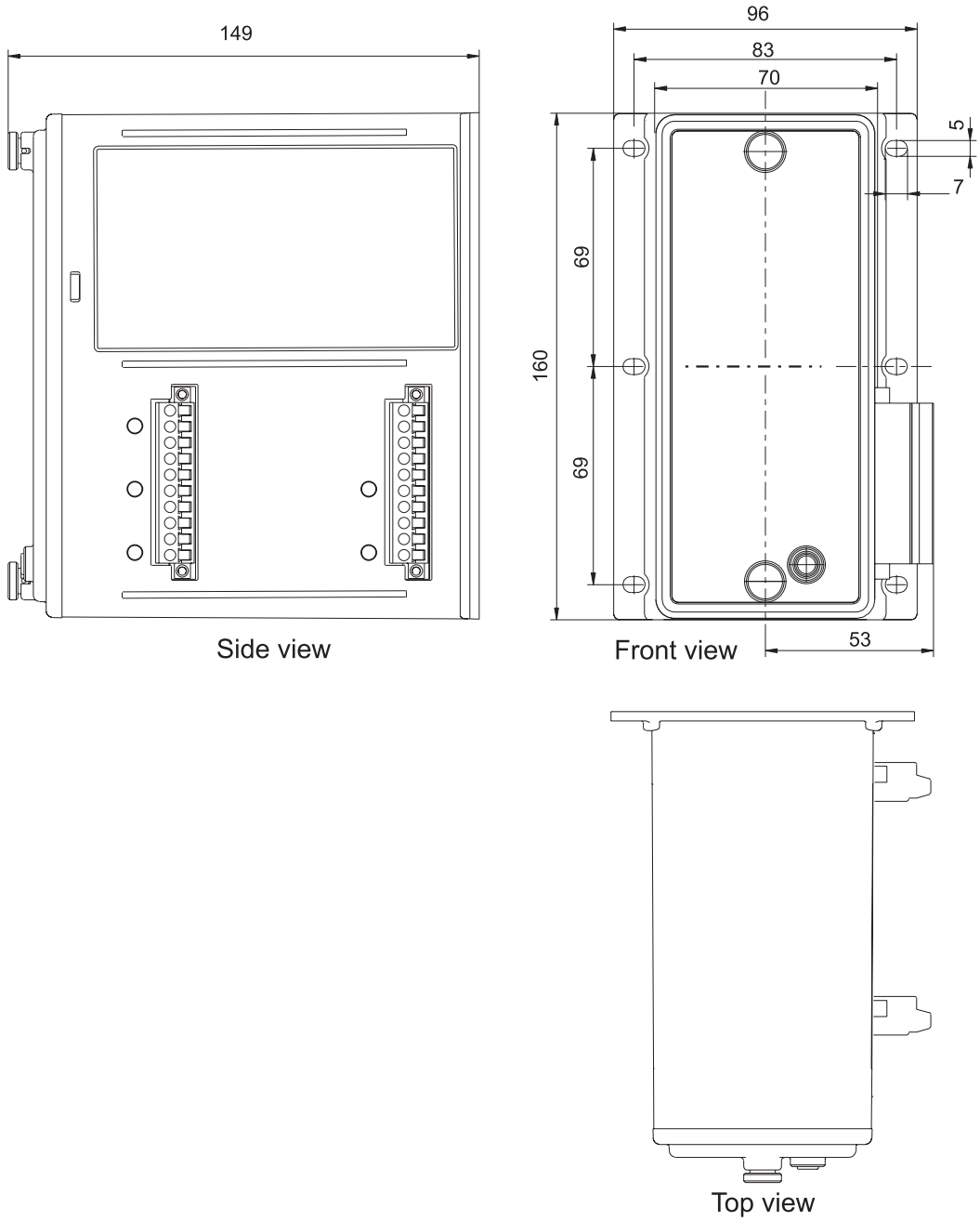



*Fig. 5. Dimension and mounting details of Self-powered feeder protection REJ603 without HMI*

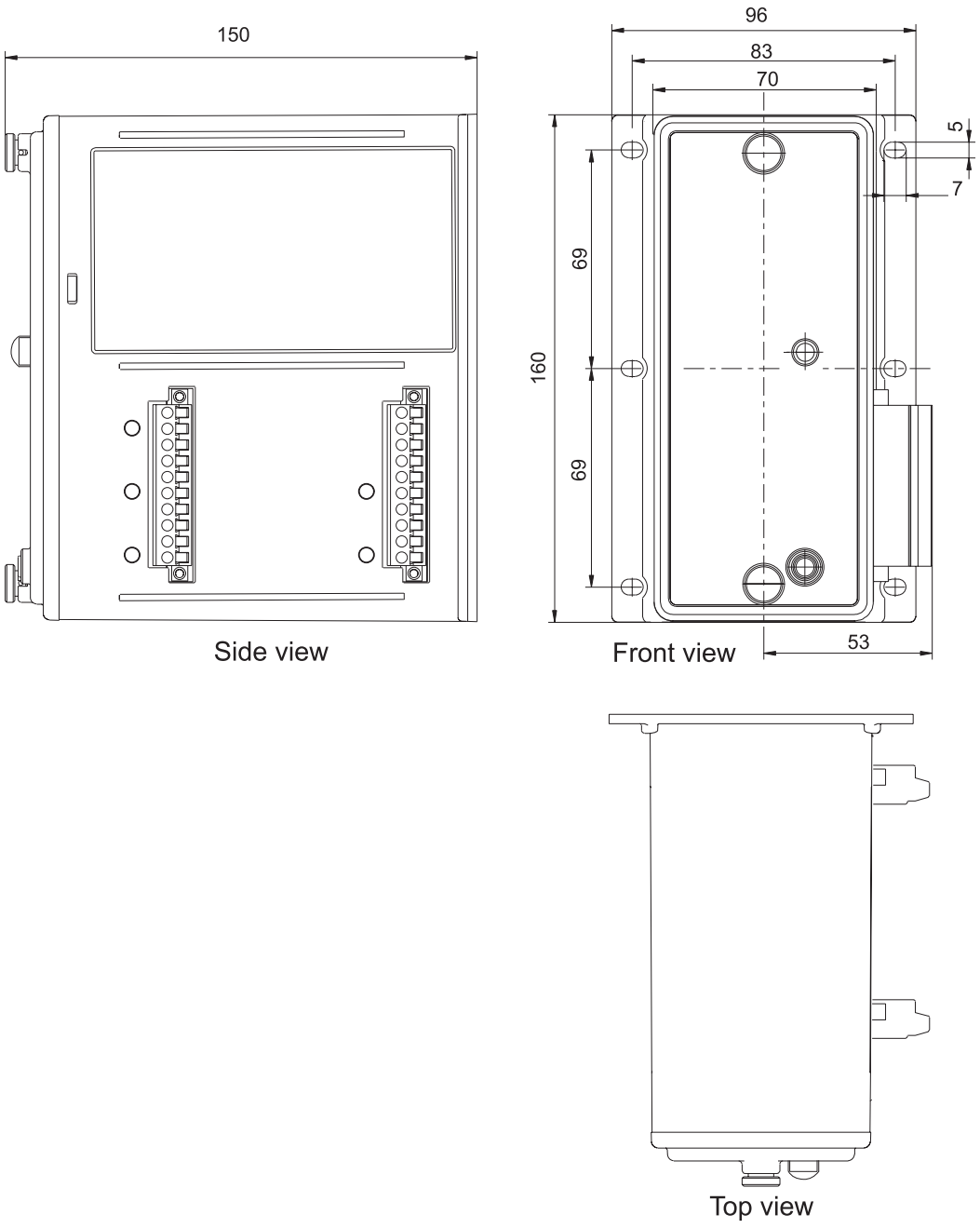



*Fig. 6. Dimension and mounting details of Self-powered feeder protection REJ603 with HMI*

# 11. Ordering details

## Relay

Order Codes :

For REJ603 with HMI : REJ603BBB10NN31C

For REJ603 without HMI : REJ603BBB10NN3XC

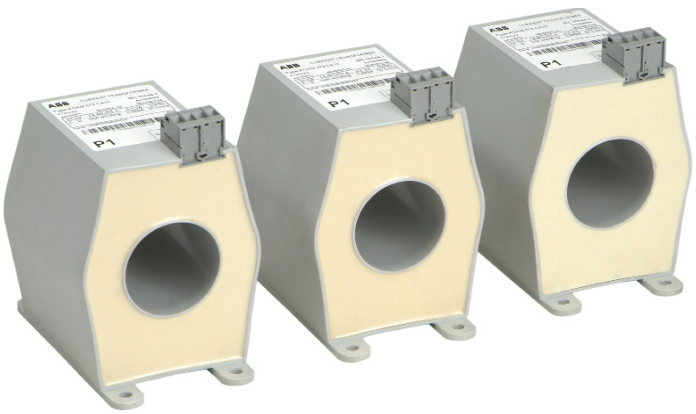
For Add-on HMI kit : REJ603BNNNNNNBZA

## Current Transformer

Note: The REJ603 requires specific ring CT's to be used for phase current measurement. It is not compatible with conventional 1 A/ 5 A CT's. The primary current setting range is adequately covered by following 4 variants of CT's .

| CT type | Rated CT current range Is |
|---|---|
| REJ603-CT1 | 8 - 28A |
| REJ603-CT2 | 16 - 56 A |
| REJ603-CT3 | 32 - 112 A |
| REJ603-CT4 | 64 - 224 A |
| REJ603-CT5 | 128 - 448 A |

For further technical information on current transformers and ordering information, please refer to the datasheet ref. 1YMA583791R0001-4.



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