Type MVAJ 05/10/20: Tripping and control relays

Protective relays are precise measuring devices, the contacts of which should not be expected to switch large electrical loads. In some cases, the protective relay may trip a circuit breaker directly, or according to the coil rating and the number of circuits to be energised, may do so using a MVAJ tripping relay. The MVAJ relay interfaces the protection relay with the circuit breaker to provide the higher contact capacity, additional contacts for tripping multiple circuit breakers, control functions, signalling and interlocking.

The MVAJ range comprises highly reliable hinged armature relays designed to directly operate circuit breaker trip coils. Built to very high specifications, the MVAJ range provides a highly flexible and reliable link between the protective relays and the circuit breakers.

Features

- Directly operates circuit breaker trip coils
- High reliability
- High speed operation
- Negligible contact bounce
- 10 contacts in Midos size 2 case
- Supplied as high burden
- Low burden selectable by removing an external link
- Hand, electrical, hand or electrical and self reset versions
- Reset inhibition feature
- Immunity to wiring capacitance discharge
- Delayed cut-off available in high burden applications
- AC or DC operation for low burden configuration
- 2.5 second time delay

Models Available

- Trip relays

  Trip relays possess a standard hand reset flag and operate within 10ms. Table 1 shows the trip relay versions available.

- Control relays

  Control relay variants of each trip relay are available. These relays possess a following flag and operate in approximately 15ms.

- All relays configured for high burden applications are suitable for dc operation only.

Application

Self reset relays reset when the initiating signal is removed, making them suitable for use as trip relays in auto-reclose schemes and also for general flagging purposes. Hand reset relays require manual resetting making them effective lockout relays, which are commonly used to trip circuit breakers associated with transformers. Electrical reset relays require a voltage to be applied to the unit to reset the contacts. These relays may be used in auto-reclose schemes, or where remote resetting of the relay is required.

Figure 1

MVAJ 05 Relay

Trip relay

With the exception of MVAJ 102 and MVAJ 202 time delayed self reset relays, all trip relays are suitable for either low burden or high burden applications.

High burden application

These relays, supplied as high burden, are suitable for use in high security circuit breaker tripping circuits. The high burden provides greater immunity to capacitance discharge currents, which can result at the inception of an earth fault on battery wiring. This makes the relays particularly suitable for use in distributed tripping or control relay contact logic schemes, where the initiating contact may be remote from the relay.

- MVAJ 05

When configured for high burden applications the burden is either cut off at operation or is economised to a low figure instantaneously.

- MVAJ 10, MVAJ 20

When configured for high burden applications the burden is either cut off or is economised to a low figure after a 40 - 60ms time delay.

Due to the greater minimum operating current, the high burden also permits the use of supervision relays such as type MVAX 11, where the wiring is at risk. The 40 - 60ms time delay ensures reliable operation of series elements such as type MCAA repeat relays.

Where required, multiple operate lines may be used to drive a single MVAJ trip relay. In these cases MCAA relays may be connected in series with each of the operate lines to indicate which line caused the trip condition.

Type MVAJ 102 and 202 relays have been specifically designed for applications requiring a tripping relay which is self-resetting after a nominal delay of 2.5 seconds.

This relay may be used, for example, for inter-tripping between higher voltage and lower voltage circuit breakers of a large three phase power transformer. This may become necessary when the higher voltage circuit breaker is tripped after a heavy internal fault, by protection which cannot conveniently provide an auxiliary contact with a dwell time long enough to ensure correct tripping of the lower voltage circuit breaker.

Typically, the relay is initiated by transformer protection, such as overall differential, restricted earth fault and Buchholz relays, in arrangements where both the HV and LV circuit breakers are to be tripped simultaneously.

The HV breaker may be expected to trip more quickly than the LV breaker so the tripping signal is maintained by the delayed reset. This ensures complete clearance by the LV circuit breaker, even though the fault may have been cleared largely by the HV breaker and the protection has started to reset.

Low burden application

These relays are suitable for general applications where the initiating contact is located close to the relay. When configured for low burden applications, by removing the external link from terminals 22 and 24, the burden is either cut off during operation or is economised to a low figure instantaneously.

Control relay

Control relay variants of the standard trip relay are suitable for applications where the operating time of the unit is not critical but where the condition of the armature should be clear from the position of the following flag.

Configuration

All trip relays are supplied as high burden. With the exception of MVAJ 102 and 202, they may be converted to low burden by removing the link between case terminals 22 and 24.

A second link connected between case terminals 21 and 23 enables a reset inhibitor feature to be introduced into the circuit of 10 and 20 contact electrical reset relays ensuring that the reset circuit is disabled when the operate circuit is energised.

On relay types 104, 105, 204 and 205 this link may be removed if this feature is not required.

This link must remain fitted to MVAJ 101 and 201 relays to enable the economising circuit.

Tables 2 and 3 describe the user selectable features which are available by external linkconnection.

Reset mechanism	5 contacts	10 contacts	20 contacts
Self reset	MVAJ 051	MVAJ 101	MVAJ 201
Self reset (2.5s delayed reset)	-	MVAJ 102	MVAJ 202
Hand reset	MVAJ 053	MVAJ 103	MVAJ 203
Electrical reset	MVAJ 054	MVAJ 104	MVAJ 204
Hand and electrical reset	MVAJ 055	MVAJ 105	MVAJ 205

Table 1

Trip relay model variants

Description

General

The relays are built around a simple magnetic latch system which holds the attracted armature unit in the operated state. Versions have either one or two elements depending upon the number of output contacts required. The contacts themselves have been designed specifically to minimise the amount of contact bounce experienced on the relay.

Hand reset relays types MVAJ 053, 103, 203

These relays incorporate an internal break contact RL1-A in series with the operate coil of attracted armature unit RL1. This contact breaks the coil circuit and reduces the burden to zero for all relays in the low burden configuration and for the MVAJ 053 relay in high burden configuration.

For type MVAJ 103 and 203 relays configured for high burden operation, as supplied, the burden is reduced to approximately 100W for 40-60ms before being cut off to zero. When the break contact cuts-off RL1, the high burden is held through R5 until the time delay circuit switches it out. This time delay t allows any flagging or auxiliary element in series with the tripping relay to operate before full cut-off.

The relay is reset by means of a push-button located on the front cover. For type MVAJ 20 relays each element is reset separately.

Electrical, hand/electrical reset relays types MVAJ 054, 055, 104, 105, 204, 205

These relays operate similarly to the hand reset relays. The internal break contact in series with the operate coil breaks the coil circuit and reduces the burden to zero for all relays in the low burden configuration and for the MVAJ 054 and 055 relays in high burden configuration.

For type MVAJ 104, 105, 204 and 205 relays configured for high burden operation, as supplied, the burden is reduced to approximately 100W for 40-60ms before being cut off to either zero or an economised level.

For a hand/electrically reset relay, once the main attracted armature unit is latched in the operated state internal contact RL1-B closes, thus enabling the reset circuit. The relay may then be reset by energising the reset coil by means of closing the reset contact. If the reset contact is closed while the protective contact PR is also closed, the relay will oscillate between operated and reset states.

If required, the reset inhibitor may be activated by linking case terminals 21 and 23. This circuit ensures that while PR is closed contact RL2-1 is open, stopping the reset circuit from being simultaneously energised and thus protecting the circuit.

Self reset relays types MVAJ 051, 101, 201

Self reset relays operate in the same manner as the hand and electrical models but have a residual gap in the magnetic path to ensure that they reset.

For a self-reset relay, when the attracted armature unit RL1 is energised by the protection contact PR, contact RL1-A opens, switching in resistance in series with RL1 and reducing the burden to a level sufficient to hold RL1 in the operated condition. On the opening of PR this economised burden is removed and RL1 resets.

For all relays in the low burden configuration and for the MVAJ 051 relay in high burden configuration the burden is economised instantaneously. For type MVAJ 101 and 201 relays configured for high burden operation the burden is reduced to approximately 100W for 40-60ms before being cut off to an economised level. The external link between case terminals 21 and 23 must remain fitted on these relays.

Relay type	Feature	Link in	Link out
MVAJ 051, 053, 054, 055	Burden	High	Low
	Cut-off	Instantaneous	Instantaneous
MVAJ 101, 103, 104, 105	Burden	High	Low
201, 203, 204, 205	Cut-off	40-60ms time delayed	Instantaneous
MVAJ 102, 202 burden models	Link not necessary – as configured as high		

Note: At the point at which the relay cut-off occurs the current drawn by the relay is either reduced to an economised level or is removed entirely (ie. zero watt cut-off state for MVAJ 05 or 2mA for MVAJ 10 and MVAJ 20).

Table 2 | Configuration of high/low burden link (terminals 22 to 24)

Relay type	Feature	Link in	Link out
MVAJ 051, 053, 054, 055, 102, 202	Link not available		
MVAJ 101, 201	Link fitted (relay cut-off to economised state)		
MVAJ 103, 203	Link not available (relay cut-off to zero watts)		
MVAJ 104, 105, 204, 205	Cut-off state	economised	zero watts
	reset inhibitor	active	disabled

Table 3 | Configuration of economising/reset inhibit link (terminals 21 to 23)

2.5 second time delayed self reset relays types MVAJ 102, 202

The MVAJ 102 and 202 relays can accept either a fleeting initiation or persistent initiation. With the latter, the relay will provide a tripping signal of corresponding duration plus the 2.5s time delay. This relay uses the same basic principal of operation as that described for the standard self reset relay. The burden is reduced to an economised level 40-60ms after operation.

For a time delayed self reset relay, the connection to terminal 25 is used to hold the relay in the energised state until a timer on the circuit board times out. The timer begins the timing sequence when the PR contact opens.

Flagging

Standard flag

All MVAJ trip relays are fitted with a standard hand reset flag which drops upon the operation of the relay. When the relay is reset the flag stays in the operated state indicating that a fault has occurred. The flag(s) may be reset by means of a lever on the cover.

Following flag

Following flags are generally fitted to relays required for control functions. Upon the operation or reset of the relay the flag follows the armature to indicate the current condition of the relay.

Where the following flag is fitted, the operation of the relay is increased to approximately 15ms which is generally unsuitable for trip relay applications.

Technical Data

Ratings

	Rated voltage (Vx)	Operative range (V)
• Auxiliary voltage (Vx)	24/27	14.4 - 32.4
	30/34	18.0 - 40.8
	48/54	28.8 - 64.8
	110/125	66 - 150
	220/250	132 - 300
• Minimum operate voltage	35% of lower rated voltage	

Burdens

	Burden at higher rated voltage (W)			Minimum operating current (mA)	
	To operate*	Operated	To reset	up to 125V*	220/250V*
MVAJ 05	80/150	≤5	<40	>25/50	>10/20
MVAJ 10	50/150	≤4	<40	>25/50	>10/20
MVAJ 20	50/150	≤4	<80	>25/50	>10/20

* low/high burden configuration

Operate time

	Operate time (Standard flag)	Operate time (Following flag)
MVAJ 05	<8ms	15ms
MVAJ 10	<8ms	15ms
MVAJ 20	<10ms	15ms

The relay operate time will not increase by more than 1ms due to contact bounce.

Reset time

- Self reset relays <20ms
- 2.5s delayed self reset c. 2.5s
- Electrical reset <15ms

Operation indicator

All relays are available with either a hand reset flag or a following flag.

Contacts

See Table 4 for contact combinations available

Contact ratings

Make and carry for 3 seconds	ac 7500VA with maxima of 30A and 300V dc 7500W with maxima of 30A and 300V
Make and carry continuously	ac 1250VA with maxima of 5A and 300V
Break	dc 1250W with maxima of 5A and 300V ac 1250VA with maxima of 5A and 300V dc 80W resistive 40W inductive (L/R=0.04s) with maxima of 5A and 300V

Durability

Loaded contact	10,000 operations minimum
Unloaded contact	100,000 operations minimum

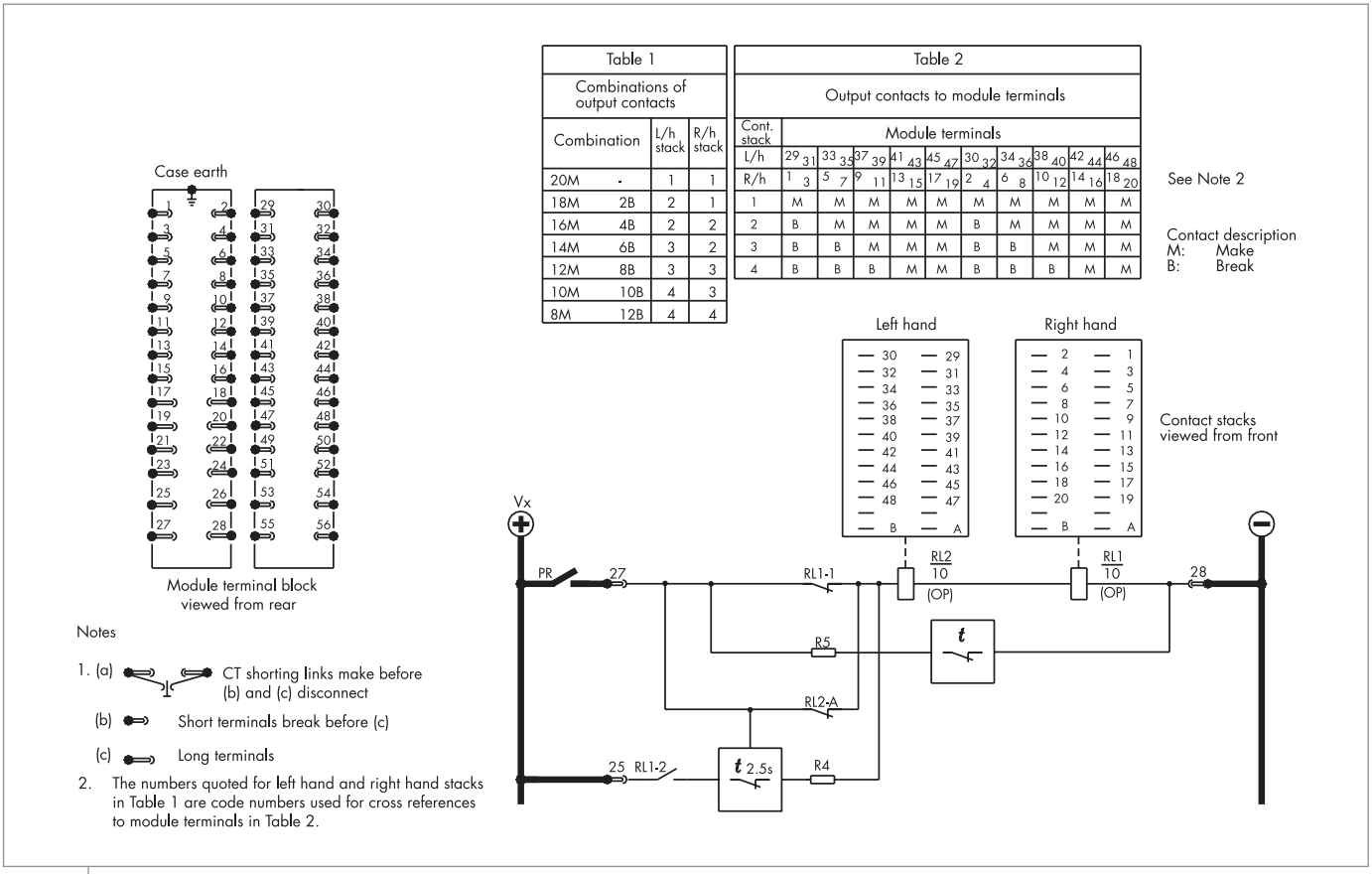

Figure 2 | Type MVAJ 103 hand reset relay circuit

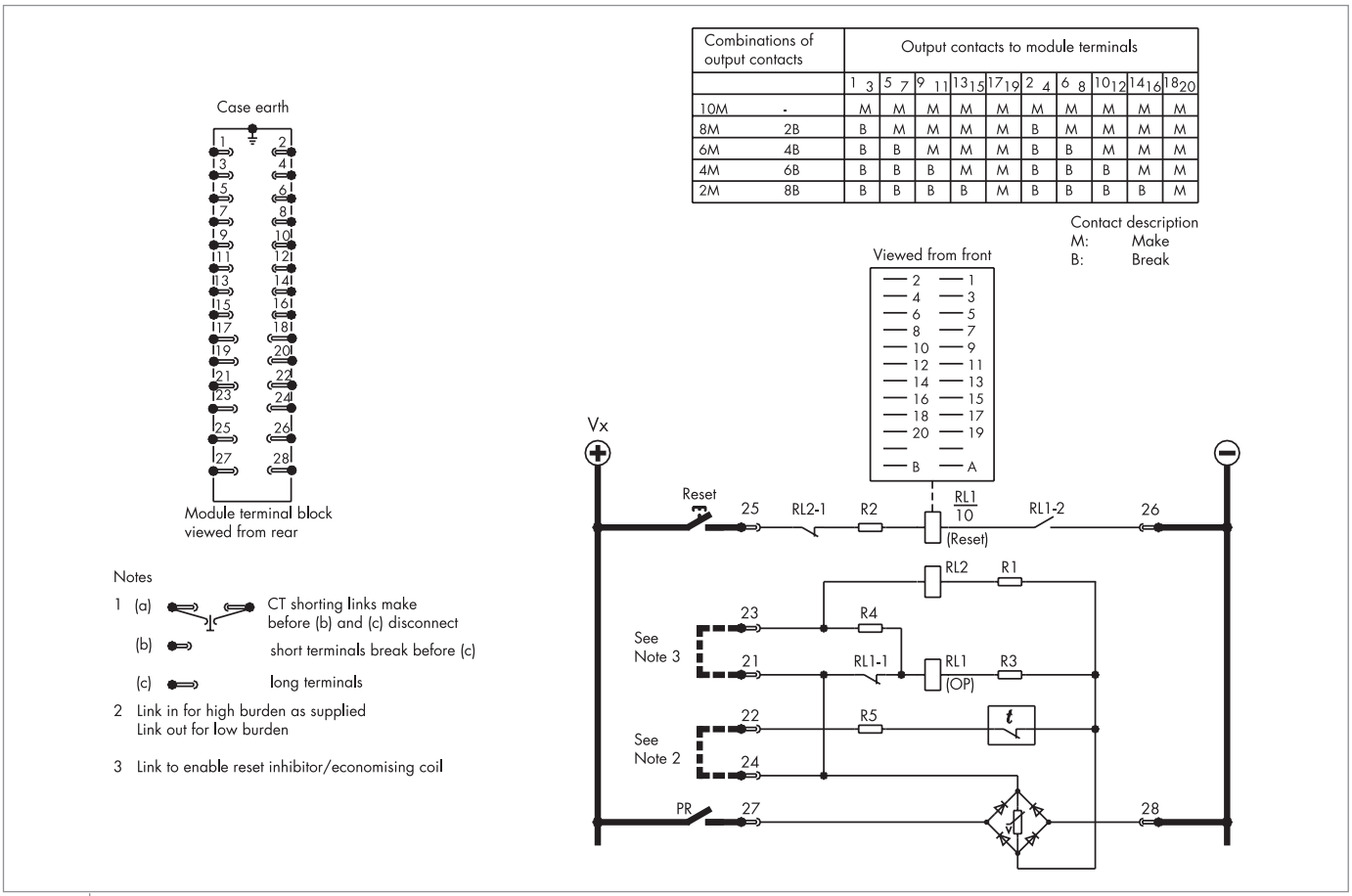

Figure 3 | Type MVAJ 105 hand/electrical reset relay circuit

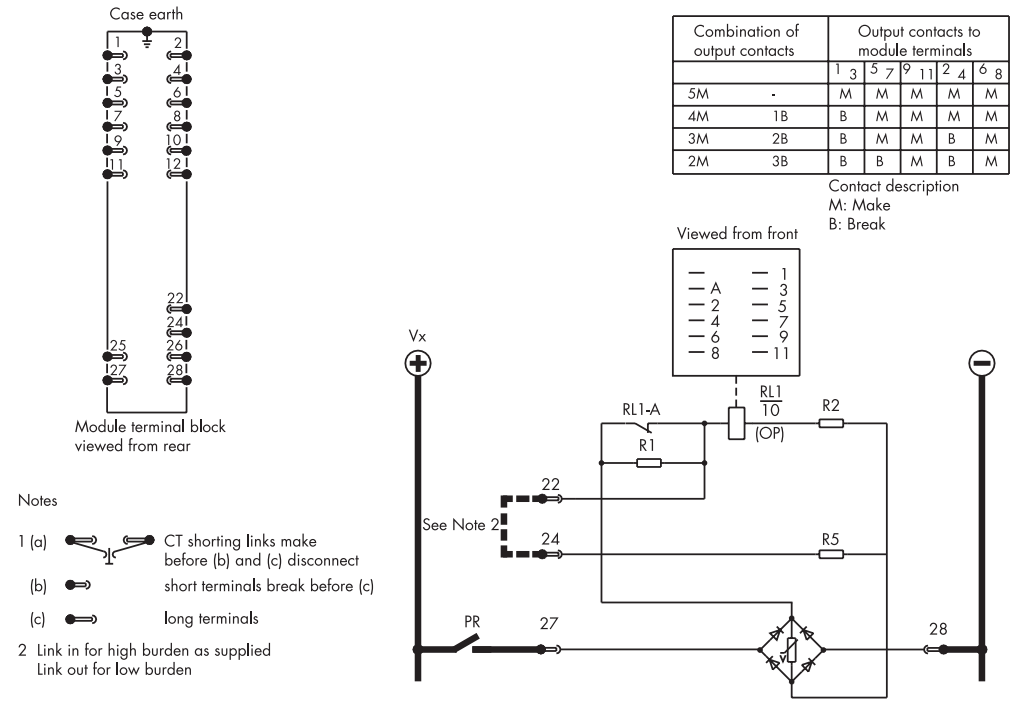

Figure 4 | Type MVAJ 051 self reset circuit

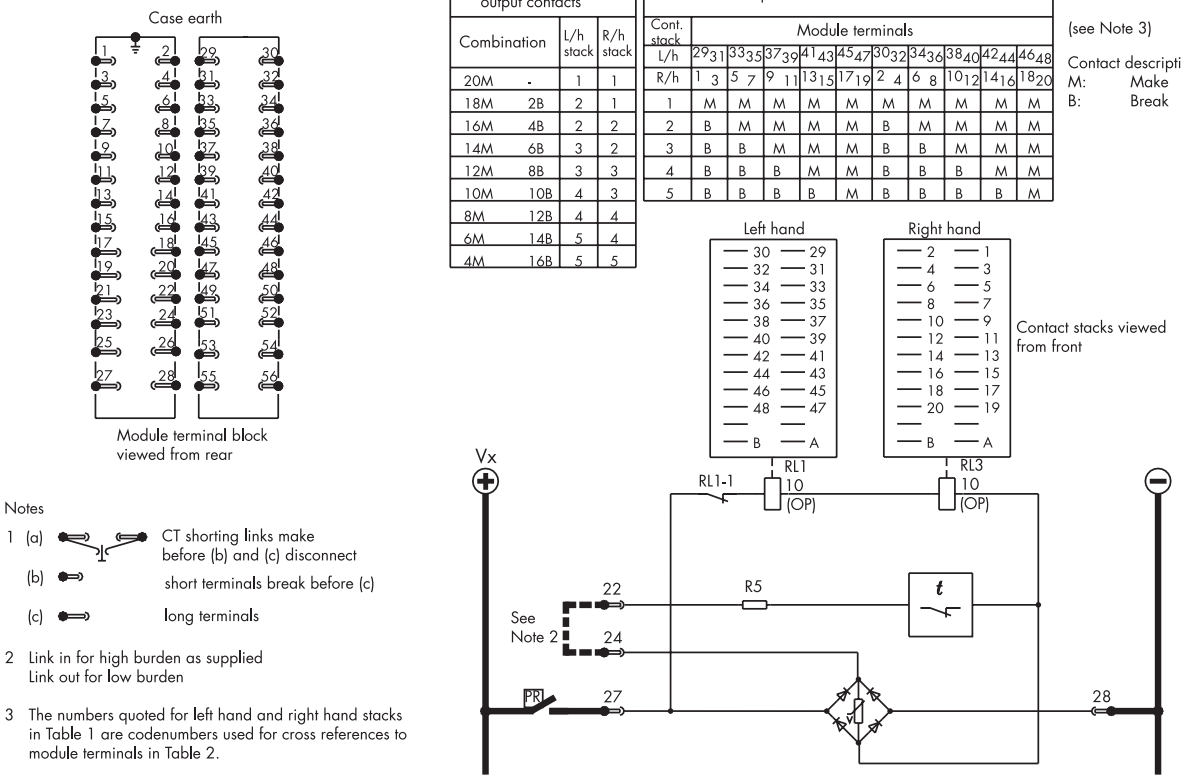

Figure 5 | Type MVAJ 202 self reset (2.5s delayed reset) circuit

Table 4 | Contact combinations available

Make	Break	MVAJ 051 MVAJ 053 MVAJ 054 MVAJ 055	MVAJ 101 MVAJ 102	MVAJ 103 MVAJ 104 MVAJ 105	MVAJ 201 MVAJ 202	MVAJ 203 MVAJ 204 MVAJ 205	CC*
5	0	•					00
4	1	•					01
3	2	•					02
2	3	•					03
10	0		•	•			00
8	2		•	•			02
6	4		•	•			04
4	6		•	•			06
2	8			•			08
20	0				•	•	00
18	2				•	•	02
16	4				•	•	04
14	6				•	•	06
12	8				•	•	08
10	10				•	•	10
8	12				•	•	12
6	14					•	14
4	16					•	16

* Contact combination required when ordering - use on page 8.

Capacitance discharge withstand

- High burden configuration

  For relays with rated voltage up to and including the 125V, the relays will withstand, without operating, a discharge into their operate circuits of a 10µF capacitor charged to 120% of the higher rated voltage for the relay.

  For relays with rated voltage of 220/250V, the relays will withstand, without operating a discharge into their operate circuits of a 10µF capacitor charged to 110% of the higher rated voltage for the relay, ie. 275V.

- Low burden configuration

  When operating in low burden configuration, the relays will withstand, without operating, a discharge into their operate circuit of a 1µF capacitor charged to 120% of the higher rated voltage for the relay.

Specifications

ESI 48-4 EB1:1983 - Low burden

ESI 48-4 EB2:1983 - High burden

High Voltage Withstand

- Dielectric withstand

  IEC 60255-5:1977

  2kV rms for 1 minute between all terminals and case earth.

  2kV rms for 1 minute between terminals of independent circuits with terminals on each independent circuit connected together.

  ANSI/IEEE C37.90: 1989

  1.5kV rms for 1 minute across normally open contacts.

- High voltage impulse

  IEC 60255-5:1977

  Three positive and three negative impulses of 5kV peak,1.2/50µs. 0.5J between all terminals of the same circuit (except output contacts), between independent circuits, and between all terminals connected together and case earth.

Electrical Environment

- AC ripple on dc supply

  IEC 60255-11:1979

  The unit will withstand 12% ac ripple on the dc supply.

- High frequency disturbance

  IEC 60255-22-1:1988 Class III
  2.5kV peak between independent circuits and between independent circuits and case earth.

  1.0kV peak across terminals of the same circuit except metallic contacts.

- Electrostatic discharge

  IEC 60255-22-2:1996 Class 3

  8kV discharge in air with cover in place

  6kV contact discharge with cover removed.

- Fast transient disturbance

  IEC 60255-22-4:1992 Class IV

  4kV, 2.5kHz applied directly to auxiliary supply.

  4kV, 2.5kHz applied directly to all inputs.

- Surge immunity

  IEC 61000-4-5:1995 Level 3

  2kV peak, 1.2/50µs between all groups and case earth.

  1kV peak, 1.2/50µs between terminals of each group.

- IEEE Radiated immunity

  ANSI/IEEE C37.90.2:1995

  25 - 1000MHz
  zero and 100% square wave modulated
  Field strength 35V/m

- IEEE Surge withstand capability (SWC)

  ANSI/IEEE C37.90.1:1989

  4kV fast transient and 2.5kV oscillatory applied directly to each input and earth

  4kV fast transient and 2.5kV oscillatory applied directly across each output contact, opto input and power supply circuit

- EMC compliance

  89/336/EEC
  Compliance to the European Commission Directive on EMC is claimed via the Technical Construction File route.

  CE EN50081-2:1994
  EN50082-2:1995

  Generic Standards were used to establish conformity.
- Product Safety

  72/23/EEC Compliance with the European Commission low voltage directive

  EN 61010-1:1993/A2:1995

  EN 60950:1992/A11:1997
  Compliance is demonstrated by reference to generic safety standards.

Atmospheric Environment

- Temperature

  IEC 60255-6:1988

  Storage and transit –25°C to +70°C

  Operating –25°C to +55°C

  IEC 60068-2-1:1990/A2: 1994
  Cold

  IEC 60068-2-2:1974/A2: 1994
  Dry heat
- Humidity

  IEC 60068-2-3:1969

  56 days at 93% RH and +40oC.
- Enclosure protection

  IEC 60529:1989

  IP50 (dust protected)

Mechanical Environment

- Vibration

  IEC 60255-21-1:1988

  Response Class 2
  Endurance Class 2
- Shock and bump

  IEC 60255-21-2:1988 Shock response Class 2
  Shock withstand Class 1
  Bump Class 1
- Seismic

  IEC 60255-21-3:1993

  Class 2

Cases

MVAJ 05 and MVAJ 10 relays are housed in size 2 Midos cases as shown in Figure 2.

MVAJ 20 relays are housed in size 4 Midos cases as shown in Figure 3.

Additional information

Service Manual	R8141
Product Guide	PG6141

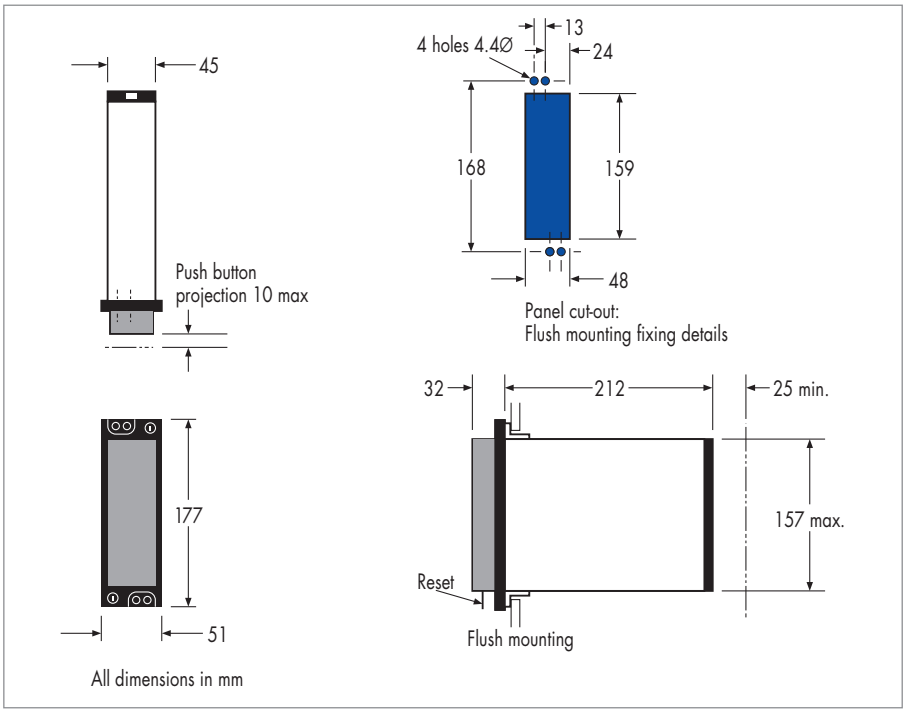

Figure 6 | Case outline size 2

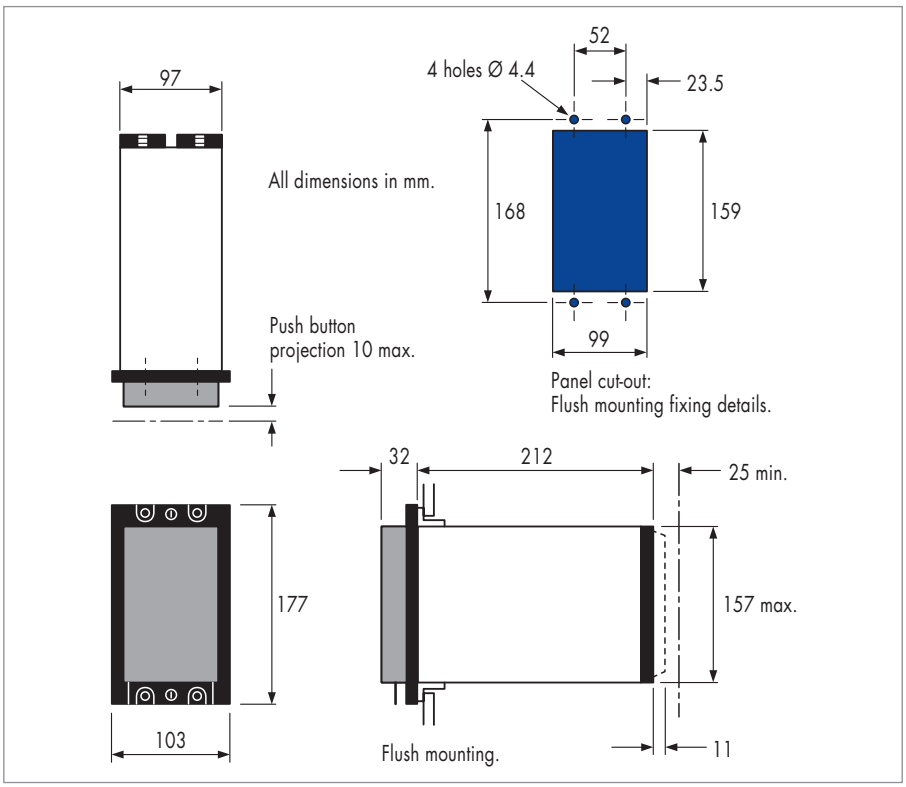

Figure 7 | Case outline size 4

Information required with order

Relay Type: M V A J

Number of contacts:

5 contact	0 5
10 contact	1 0
20 contact	2 0

Contact mechanism:

Self reset	1
2.5s delayed self reset (not available with 5 contacts)	2
Hand reset	3
Electrical reset	4
Hand/electrical reset	5

Case size:

5/10 contacts - size 2 case	B
20 contacts - size 4 case	D

Flag:

Standard hand reset flag (trip relay)	A
Following (self reset) flag (control relay)	B

Voltage rating:

24/27 V	0 0
30/34 V	0 2
48/54 V	0 5
110/125 V	0 8
220/250 V	1 0

Output contact configuration

Reference should be made to Table 4, page 6	CC

Design Suffix

Please leave case size and design suffix blank as these will be completed by AREVA T&D