

Features

SYSTEM FEATURES

- Large back lit display panel
- System status LED indicators
- Simple menu setting procedure
- Wide auxiliary supply range with fail alarm contact
- Self diagnosis & fail alarm
- Size 4M draw out case
- Made in Australia

CONTROL MONITORING

- Tap change out of step alarm
- Pre-configured parallel control schemes – refer 1M122 technical bulletin

DATA DISPLAY

- Tap position indicator input for up to four (4) transformer tap changers
- Reference tap position indicator output
- Transformer “In Step” status

COMMUNICATION

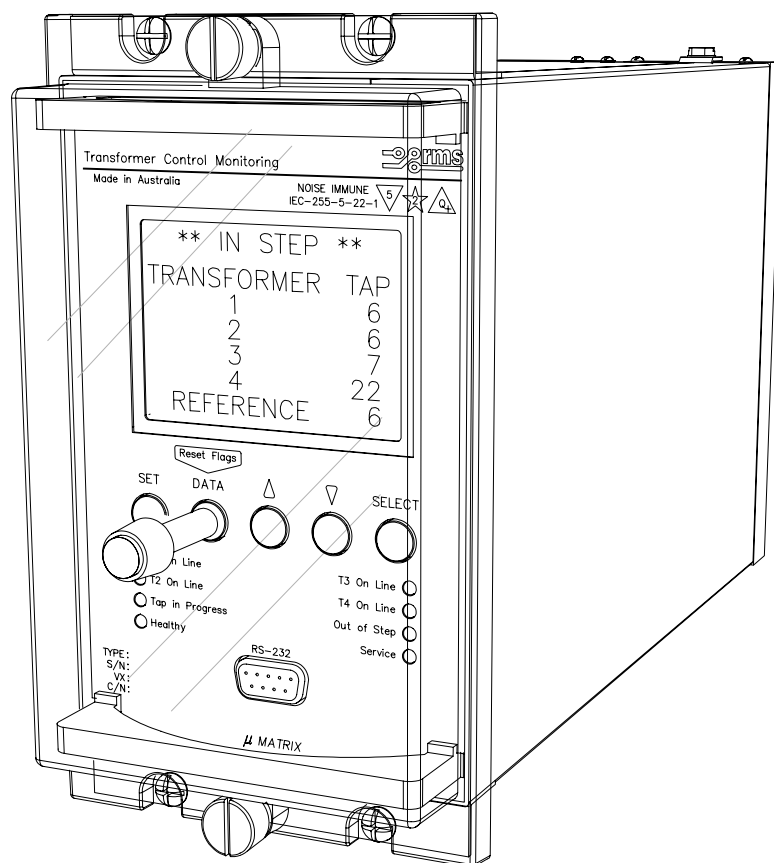
- Non platform specific PC programming software
- Optically isolated communication ports
- MODBUS RTU compatible network protocol

Operation

The 2V165 relay is built on the Micro MATRIX digital platform. The standard Micro MATRIX human machine interface (HMI) is combined with fully solid-state voltage sensing & measuring circuitry to provide high accuracy, simple set up & flexible operation. Self-monitoring is carried out by hardware & software watchdogs.

The TPI inputs, output relays & opto isolated status inputs form the essential barriers against high voltage line transients while a switchmode auxiliary supply provides a wide operating range.

An RS232 programming port is provided for ease of establishing relay settings using a PC.



2V165 depicted in a 4M56 case

Application

Made in Australia

The 2V165 Series relays are designed to monitor & control the tap changers of up to four (4) transformers connected on a common bus & operating in the master slave control configuration.

Master follower parallel control schemes traditionally use auxiliary switches on the tap changers to determine out of step errors. While this is a reliable & proven technique there are two significant drawbacks:

1. Wiring complexity between the tap changer auxiliary switches
2. Requirement for matched tap changers

The first issue is overcome by replacing each tap changer auxiliary switch with a TPI transducer (2V200), which sends a frequency signal proportional to the tap position. This requires only two wires for each tap changer & is simply wired back to the 2V165. The second issue is overcome with a user specified tap position logic table in the 2V165 to allow non-matched tap changers to operate together.

The tap position of each transformer is monitored as well as the raise / lower commands initiated by the selected master voltage regulating relay. The 2V165 responds by sending the appropriate raise / lower commands to each tap changer in accordance with the tap position logic table.

If any tap changer moves outside the limits established in the tap position logic table, an out of step alarm contact will pick up & all further tap change commands inhibited.

Any or all of the transformers may be taken off the parallel scheme & operated independently. This is signaled to the 2V165 via status inputs, which inhibit any tap change commands or alarm outputs relating to that transformer.

A status input is provided to automatically step all tap changers to a programmed position within the tap position logic table.

RMS 2V165 Relays have many in built features to simplify the interface with OLTC's to provide a reliable, effective & simple to operate voltage control system.

Refer to the 1M122A & 1M122B technical bulletins for pre-configured system solutions.



Control Functions

TPI INPUTS

Four (4) TPI inputs are provided to accept a 1 to 5K HZ frequency coded signals from the RMS manufactured 2V200 TPI transducers. The 2V165 is programmed with the number of taps & direction for each transformer. A table is established by the user for the correct tap positions relative to a reference position. e.g.

Reference	Tap 1	Tap 2	Tap 3	Tap 4	Tap 5	...	Tap n
Transformer 1	1	2	3	4	5	...	n1
Transformer 2	1	2	3	4	5	...	n2
Transformer 3	1	1	2	2	3	...	n3
Transformer 4	20	19	18	17	16	...	n1

Pre-defined tap position logic table

If the tap of any transformer steps outside the pre-defined band the out of step contact will pick up. A user specified time delay (1-30s in 0.5s steps), is provided to allow for differences in tap changer operate times.

It should be noted that this table is only required when tap changers are not matched. The tap position logic table template on this page should be completed & supplied with the 2V165 ordering code where unmatched tap changers are to be used. The 2V165 will then be supplied pre-programmed with the specified configuration.

TAP RAISE / LOWER INITIATE INPUTS

Two (2) separate status inputs are provided to detect tap raise & tap lower initiate signals from the master voltage regulating relay. These are used to allow the 2V165 to check that tap position changes only occur in synchronization with tap raise / lower commands. An input control signal of 1s minimum duration is required.

TAP RAISE / LOWER INITIATE OUTPUTS

When a tap raise or lower input is detected the 2V165 sends specific tap change output commands to each transformer such that the positions in the pre-defined tap position logic table are observed. A continuous contact output is provided which is reset when the corresponding tap position indicator changes position. Tap raise must be wired to provide an increase in system volts. Tap lower must be wired to provide a reduction in system volts.

OUT OF STEP ALARM

When a tap raise or lower command is output, an out of step alarm timer is initiated. If all tap changers have not moved to the specified tap within the user specified time delay (1-30s in 1s steps), the alarm contact will close & a message identifying the problem tap changer displayed.

TAP CHANGE FEEDBACK OUTPUT CONTACT

This contact is closed when a tap raise / lower command pulse is received from the 2V164 AVR & is reset when all transformers have successfully moved to the next position in the tap position logic table. This contact is wired back to the 2V164 tap change feedback status input to pause the interval timer from starting until all transformers have completed the tap change sequence.

ALL TRANSFORMERS OFF GROUP OUTPUT CONTACT

When all transformers are set to OFF GROUP via the ON GROUP status inputs, this N/O contact is closed. This function is useful to automatically inhibit the local AVR to avoid tap change fail & voltage level alarms.

IN GROUP STATUS INPUTS

A status input is provided for each transformer to signal if the transformer is operating as part of the parallel group. This is indicated by an LED on the front panel with the text ON GROUP. Tap raise & lower commands will be inhibited for transformers not ON GROUP & its tap position not used to initiate an out of step alarm.

AUTO HOME

When a transformer is put back ON GROUP it will automatically home to the Reference Tap Position to match the other transformers ON GROUP. A user specified time delay (10-300s in 5s steps), is provided to allow for the tap changer to reach the specified target position during which period the Out of Step alarm is inhibited.

GO TO SPECIFIED TAP

A status input is provided which may be initiated to drive all ON GROUP transformer tap changes to a user specified reference tap position. An initiate pulse of 1s minimum is required.

OPERATIONAL INDICATORS

LEDs indicate the following conditions.

- Transformer 1 ON GROUP
- Transformer 2 ON GROUP
- Transformer 3 ON GROUP
- Transformer 4 ON GROUP
- Tap change in progress
- Out of step alarm
- Healthy
- Service

DATA DISPLAY

During normal operation the front panel LCD provides the following information:

- The tap position of each transformer
- Transformer out of step status

TPI ANALOGUE OUTPUT

A single tap position indicator analogue output signal is provided for interface to an RTU. The analogue output is linked to the reference tap position (= transformer 1 tap position if matched tap changers are used).

- Output: 4 to 20mA
- Compliance voltage: 5V
- Maximum burden: 250 Ohms
- Accuracy: +/-3%
- Analogue output:
 - Tap 1 4mA
 - Tap N 20mA
 Where N = maximum selected tap setting

TAP POSITION LOGIC TABLE TEMPLATE – Table 1 (Only required when tap changers are not matched)

	Reference Tap Position																													
	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
T1																														
T2																														
T3																														
T4																														

Complete this table with the desired relative transformer tap positions & submit with the ordering code for factory programming. Increased transformer voltage output is to the right. i.e. an increase in the reference tap position will result in an increase in system voltage.



RELAY FAIL ALARM

A C/O alarm contact is maintained in the energized state when all of the following conditions are met:

- The auxiliary supply is applied
- The internal 24V DC rail is within acceptable limits
- The CPU hardware watchdog maintains a pulsing output

A CPU software watchdog records "suspect" events to an assert register and if necessary performs a soft restart.

OUTPUT CONTACT RATINGS

Make & carry

30A AC or DC (Limits L/R=40ms & 300V max.) for 0.2s
 20A AC or DC (Limits L/R=40ms & 300V max.) for 0.5s
 5A AC or DC continuously

Break (Limits 5A & 300V max.)

1,250VA AC resistive
 250VA at 0.4PF AC inductive
 75W DC resistive
 30W DC inductive L/R = 40ms
 50W DC inductive L/R = 10ms

INSULATION WITHSTAND

IEC60255-5 2KV RMS & 1.2/50 5KV impulse between:

- ◆ all input terminals & frame
- ◆ all output terminals & frame
- ◆ all input & output terminals
- ◆ each input group
- ◆ each output group

HIGH FREQUENCY DISTURBANCE

IEC60255-22-1 2.5KV 1MHz common mode
 1.0KV 1MHz differential mode

ELECTROSTATIC DISCHARGE

EN61000-4-2:1995 8KV Level 3

RADIO FREQUENCY INTERFERENCE

EN61000-4-3:1995 10V/m Level 3

FAST TRANSIENT DISTURBANCE

EN61000-4-4:1995 4KV Level 4

OPERATING TEMPERATURE RANGE

-5 to +55 degrees Celsius ambient operating temperature range.

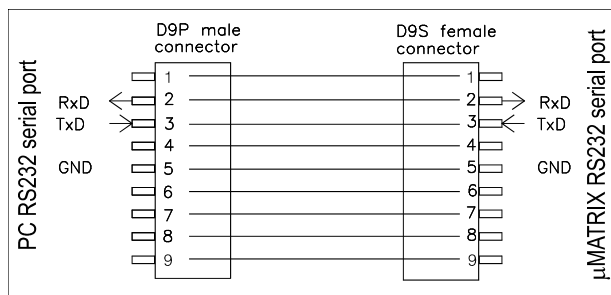
ACCESSORIES SUPPLIED WITH EACH SYSTEM

1 x M4 self threading mounting screw kit P/N 290-406-151
 2 x M4 terminal screw kit (28 per kit) P/N 290-407-153
 1 x Product Test Manual

PC TO μMATRIX SERIAL CABLE

One cable supplied with each order.
 P/N 290-406-151

PROGRAMMING PORT SERIAL CABLE



COMMUNICATIONS

Two (2) communications ports are available.

Programming port

The programming port is accessible from the front panel of the relay via an RS232 physical link & PC configuration program supplied with the relay. The μMATRIXwin configuration program is designed to operate with all relays from the Micro MATRIX range & with all installed firmware version.

Network port

The network port is intended for applications where permanent connection to a master control system is required. An optically isolated RS232 or RS485 physical layer is provided for this function.

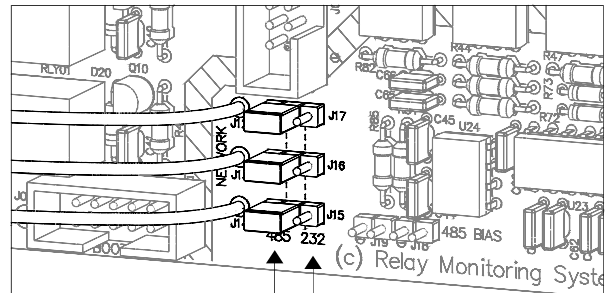
The RS485 connection is intended for applications where multiple μMATRIX relays are to be connected on a common communications bus.

The RS232 connection is intended for interface to an RS232 to optic fiber converter in environments subject to extreme electrical interference.

The network port may be used for a permanent link to a modem, remote PC, data concentrator or SCADA system. The standard communications protocol is MODBUS RTU.

Changing the Network port from RS485 to RS232

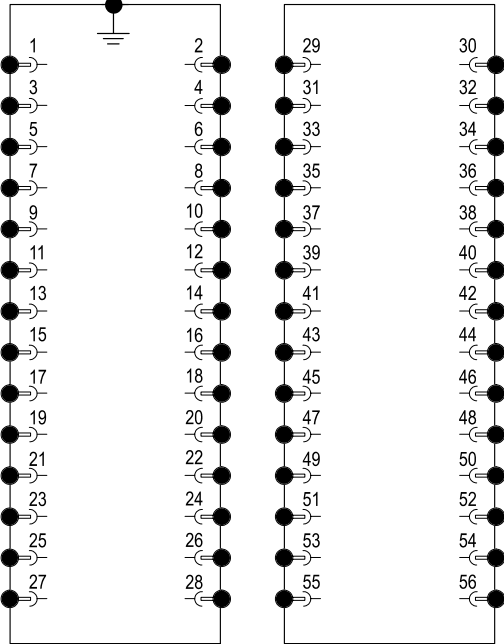
μMATRIX relays are shipped with the rear network port terminals configured as RS485. This configuration may be changed in the field to RS232 if required by withdrawing the relay module from the case & changing the three configuration links as depicted.



RS485 Port Header Position

RS232 Port Header Position

Case Earth



4M56 Case terminations (REAR VIEW)

Ordering Information

Generate the required ordering code as follows: e.g. 2V165 BBBBA

2V165



1 AUXILIARY SUPPLY RANGE

- A 20-70V DC
- B 40-300V DC / 40-275V AC

2 DIGITAL INPUT OPERATING VOLTAGE – GROUP 1

Opto-isolated input

- A 24-80V AC/DC
- B 75-150V AC/DC
- C 150-300V AC/DC

3 DIGITAL INPUT OPERATING VOLTAGE – GROUP 2

Opto-isolated input

- A 24-80V AC/DC
- B 75-150V AC/DC
- C 150-300V AC/DC

4 DIGITAL INPUT OPERATING VOLTAGE – GROUP 3

Opto-isolated input

- A 24-80V AC/DC
- B 75-150V AC/DC
- C 150-300V AC/DC

5 TPI ANALOGUE OUTPUTS

- A Not required
- B Required 4 to 20mA

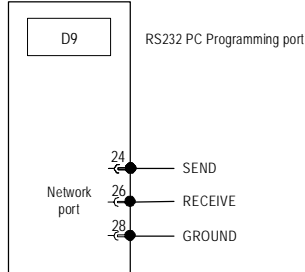


TAP POSITION LOGIC TABLE FIRMWARE

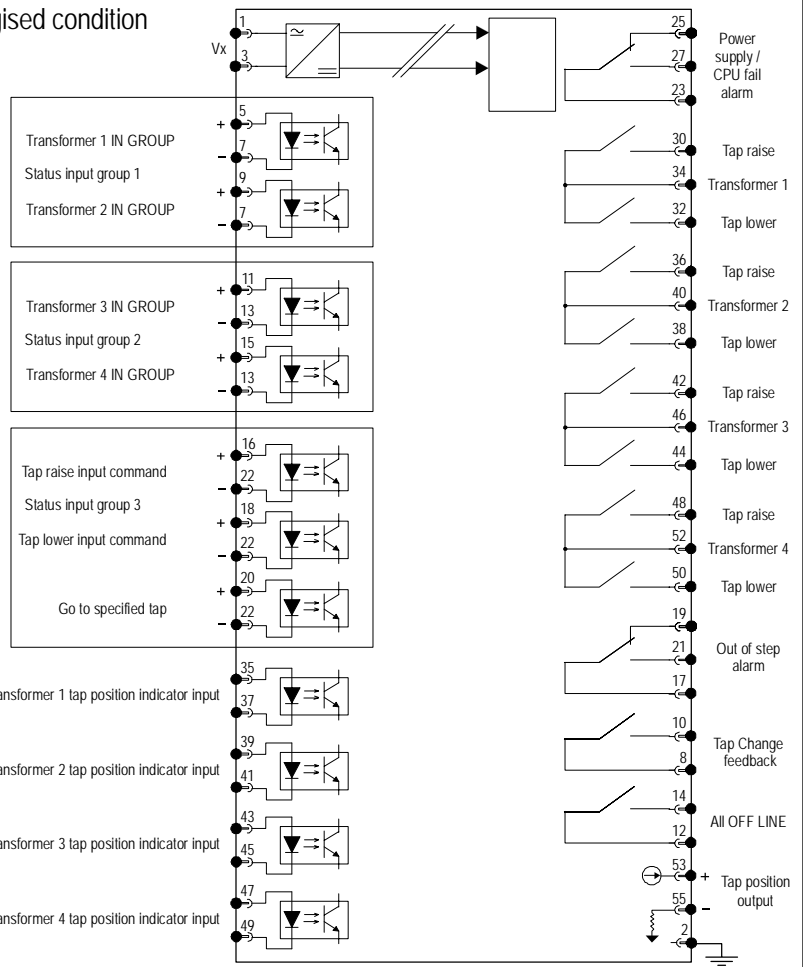
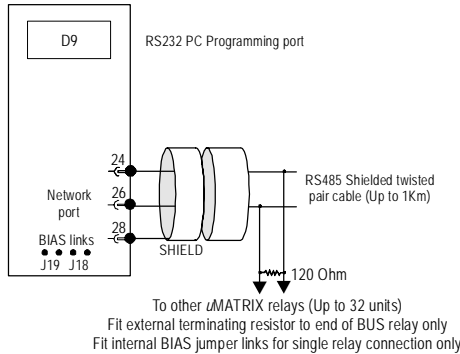
- A Not required
- B Non matched tap changers
- Matched tap changers
- Complete the table on page 2

2V165 wiring diagram - Relay shown in de-energised condition

COMMUNICATIONS
(RS 232 SCADA option)



COMMUNICATIONS
(RS 485 SCADA option)



Australian Content

Unless otherwise stated the product(s) quoted are manufactured by RMS at our production facility in Melbourne Australia. Approximately 60% of our sales volume is derived from equipment manufactured in house with a local content close to 90%. Imported components such as semi-conductors are sourced from local suppliers & preference is given for reasonable stock holding to support our build requirements.

Quality Assurance

RMS holds NCSI (NATA Certification Services International), registration number 6869 for the certification of a quality assurance system to AS/NZS ISO9001-2000. Quality plans for all products involve 100% inspection and testing carried out before despatch. Further details on specific test plans, quality policy & procedures may be found in section A4 of the RMS product catalogue.

Product Packaging

Protection relays are supplied in secure individual packing cardboard boxes with moulded styrene inserts suitable for recycling. Each product & packing box is labeled with the product part number, customer name & order details.

Design References

The products & components produced by RMS are based on many years of field experience since Relays Pty Ltd was formed in 1955. A large population of equipment is in service throughout Australia, New Zealand, South Africa & South East Asia attesting to this fact. Specific product & customer reference sites may be provided on application.

Product Warranty

All utility grade protection & auxiliary relay products, unless otherwise stated, are warranted for a period of 24 months from shipment for materials & labour on a return to factory basis. Repair of products damaged through poor application or circumstances outside the product ratings will be carried out at the customer's expense.

Standard Conditions of Sale

Unless otherwise agreed RMS Standard Terms & Conditions (QF 907) shall apply to all sales. These are available on request or from our web site.



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