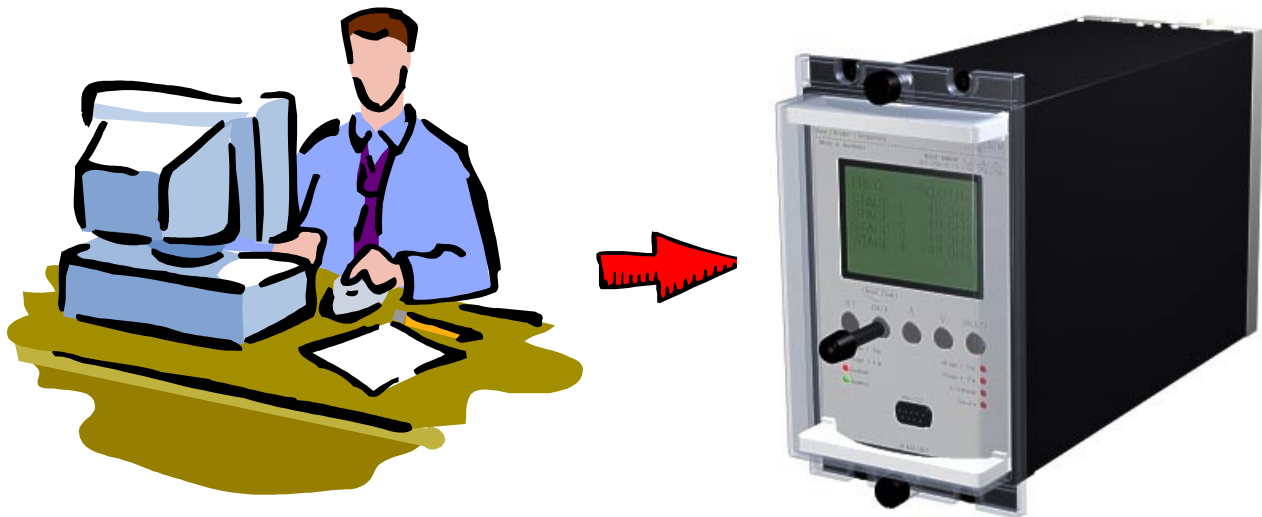


SOFTWARE FUNCTION & VERIFICATION

2V165 A UMX

TRANSFORMER PARALLEL CONTROL RELAY



Issue	Date	Summary of changes
A	18/11/2002	Initial issue.
B	19/03/2003	Revisions for 04.13 release UMX.
C	24/04/03	Revisions for 04.21 release UMX.
D	08/08/2003	Out Of Step function revised

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1.0 OVERVIEW

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

2.0 SOFTWARE VERSION CONTROL REGISTER

The following table is a register of the changes for the **UMX2V165A.umx** file.

DATE	SOFTWARE	CHANGES	BIOS	FIRST HARDWARE
18/11/2002	04.01	Initial release.	04.xx	2V165K2
28/03/2003	04.13	Lowest ON LINE transformer # sets reference tap. Remove reference tap from HMI. All tap positions displayed except OOS transformers.	04.xx	2V165K2
19/04/2003	04.21	Auto home race condition eliminated	04.xx	2V165K2
07/08/2003	0.422	Lock out transformer step commands if OOS alarm expired	04.xx	2V165K2

3.0 DESCRIPTION – UMX2V165A.UMX

3.1 Standard Features

The 2V165 provides a range of standard features as described in the RMS Technical Bulletin which may be downloaded from:

www.rmspl.com.au/handbook/2v164.pdf

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 input signals are used by the 2V165 to generate appropriate tap raise / lower commands to each ON LINE transformer. 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. A continuous contact output is provided which is reset when the corresponding tap position indicator changes position.

OUT OF STEP ALARM

When a Tap Raise/Lower command is output, an Out Of Step alarm timer is initiated. If any tap changer(s) has not moved to the specified tap within the user specified time delay, the alarm contact will close, the Raise/Lower command from the 2V165 is removed, and a message identifying the problem tap changer(s) is displayed. Intervention from another source is required to rectify the out of step fault.

REFERENCE TAP POSITION

The parallel control system uses a Reference Tap Position to determine the correct tap position for each transformer. No single transformer can be used as the reference as it may not always form part of the parallel scheme. For example when it is OFF LINE or when part of another parallel group.

The Reference Tap Position is established when a transformer is first brought ON LINE. If more than one transformer is brought ON LINE together, say during power up conditions, then the tap position of the lowest ON LINE transformer number is used. For example if all four transformers were placed ON LINE simultaneously then the tap position of transformer number one would be used to establish the Reference Tap Position.

The Reference Tap Position may be reset to another tap position in two ways:

1. Take all transformers OFFLINE, manually change a transformer (or group of transformers) to the desired Reference Tap and place back ONLINE.
2. Set the Go To setting to the desired tap position and activate the Go To status input.

TAP CHANGE FEEDBACK OUTPUT CONTACT

This contact is closed when a Tap Raise / Lower command is received from the 2V164 AVR & is reset when all transformers have successfully moved to the tap next position. The contact is wired back to the 2V164 Tap Change Feedback status input to pause the interval timer until all transformers have completed the tap change sequence.

ALL TRANSFORMERS OFF LINE OUTPUT CONTACT

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

PARALLEL / INDEPENDENT CONTROL STATUS INPUTS

A status input is provided for each transformer to signal if the transformer is operating as part of the parallel group or is OFF LINE. Tap raise & lower commands will be inhibited for OFF LINE transformers & its tap position not used to initiate an out of step alarm.

AUTO HOME

When a transformer is put back ON LINE it will automatically home to the Reference Tap Position to match the other transformers ON LINE. 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 LINE transformer tap changes to a user specified reference tap position. 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. An initiate pulse of 1s minimum is required.

POWER UP CONDITIONS

At initial system power up, more than one transformer may be brought back on line at the same time. In this instance the Reference Tap Position will be set to the tap position of the lowest numbered transformer (Refer section 6.4 above). Tap change commands will then be output to bring any other ON LINE transformers to the same tap position.

If some transformers require raise commands while others require lower commands, the lower commands will take priority followed by the raise commands.

OPERATIONAL INDICATORS

- LEDs indicate the following conditions.
- Transformer 1 In Group
- Transformer 2 In Group
- Transformer 3 In Group
- Transformer 4 In 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 (Optional on some hardware)

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 for matched tap changers).

Output: 4 to 20mA or 0 to 10mA

Compliance voltage: 7.5V

Accuracy: +/-0.5%

3.2 Special Features of this Software UMX Version

TPI INPUTS

Four 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.

For this UMX the tap numbers on each tap changer are matched.

As the tap changers are matched the Reference Tap Position is not displayed on the HMI. Each transformer tap position is always displayed except for out of step transformers.

4.0 USER INTERFACE

Refer to the μ MATRIX Users Guide for detailed instructions on the operation of the user interface.

To download a PDF version of the guide:

www.rmspl.com.au/digital/uMATRIXInfo.pdf

To download further μ MATRIX software & documentation:

www.rmspl.com.au/uMATRIX.htm

5.0 Loading software, Calibration & Test

This section requires at least the following:
A PC with Windows 98 or later and at least one COM port.
UMatrixWin software.
The correct serial cable.
The ability to interrogate the relay via the front panel buttons.
A general understanding of how UMX and UMP files work with the relay.

Settable parameters will be overwritten by loading a new UMX file. They can however, be saved to a UMP file and then returned to the relay later. To learn how to do this, refer to the uMatrix Userguide.

5.1 Loading the UMX

Before loading the UMX2V165A software, ensure that it is compatible with your hardware. Download the compatibility list from the RMS website at:

www.rmspl.com.au/digital/compatibility.pdf

Now ensure that the bios version in the relay matches the table in section 2.0 of this document. (If the bios version is different, you may not be able to load this UMX. Contact RMS for support.)

Load the UMX via the front panel COM port using the 'uMatrixWin' software. Now ensure that the UMX version matches the table in section 2.0.

To interrogate for versions, press 'SET' and 'DATA' buttons simultaneously, then select 'Version Page'. Alternatively, use uMatrixWin – Options – Utilities.

Check versions

The relay is now ready to calibrate. *Note: calibration is a factory function. If you are simply changing or re-loading a UMX, re-calibration is not necessary. The relay is deemed to be fully operational.*

5.2 Calibration using 'WinCal'

Test equipment required:
As 5.0 plus
A Calibrated 2V200 unit.

- a) With the 2V200 and PC connected to the relay, start Wincal, select uMatrix – Connect.
- b) Select uMatrix – Calibrate and follow the prompts. When completed, verify the following parameters.

5.3 Tap Position Indicator Verification

Check that each Transformer Tap Position displays the correct value by emulating positions at 1, 15 and 30.

VERIFY

5.4 Analogue Output Verification

Does not exist in all hardware

- a) With the TPI of Transformer No.1 set to position 1 there should be 4.7 +/-0.1mA between terminals 53 and 55 and with the TPI set to 30 there should be 20.0 +/-0.1mA.

VERIFY

If the relay settings in the above are correct, the relay is deemed to be fully operational.

TESTED BY : _____ DATE : _____

6.0 CONNECTION DIAGRAM

