

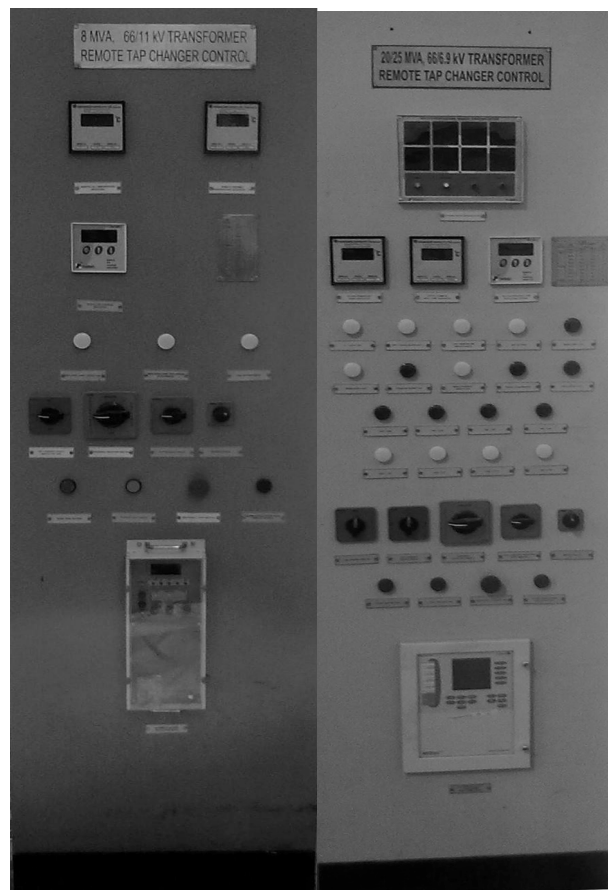
REMOTE TAP CHANGER CONTROL **PANEL**

RTCC is “Remote Tap Changer Control “which is a Programmable device to control the output of the transformer through OLTC unit fitted in the transformer through control cables. The desired voltage will be achieved accordingly by controlling the OLTC with respect to the tap position through RTCC system. The output voltage of the transformer is been maintained through an inbuilt AVR (Automatic Voltage Regulator), which continuously verifies the output power with the set / programmed reference voltage, which triggers the OLTC accordingly. Hence, by above said phenomena, the consistency of the transformer output is been maintained.

RTCC is a panel consisting of the AVR, Display for Tap Position, Voltage, LEDs for Raise & Lower of Taps relays, Selector Switches for Auto Manual Selection etc. In AUTO Mode the voltage is controlled by the AVR. In MANUAL Mode the operator can

Increase / decrease the voltage by changing the Taps manually through the Push Button in the RTCC. Normally RTCC panel will be installed in Main panel room and will be connected to OLTC (On load tap changer) of the transformer through control cable. There will be AVR in RTCC Panel to control the secondary voltage of the transformer and AVR output will control OLTC motor in Clock wise or Anti clock wise directions.

RTCC is installed with transformer HT Panel. Automatic OLTC Panel consists of a LCP and a RTCC. System uses an AVR (AVR-MA9) to sense the LV Voltage and a comparator circuit to compare the sensing voltage with a preset value. Any difference in two sends a corresponding signal to OLTC Panel to lower or raise the LV Voltage of transformer. The OLTC Control Panel also has a provision to operate two or more transformer in parallel. One transformer is taken as the master and the remaining as followers so that they follow the Master’s LV Voltage set values.



ON LOAD TAP CHANGER (OLTC)



On load Tap Changer (OLTC) is used with higher capacity transformers where HT side voltage variation is frequent and a nearly constant LT is required. OLTC is fitted with the transformer itself. Multiple tapings from HV windings are brought to the OLTC chamber and connected to fixed contacts. Moving contacts rotates with the help of rotating mechanism having a spindle. This spindle can be rotated manually as well as electrically with a motor. Motor is connected in such a way that it can rotate in both the directions so as to rotate the OLTC contacts in clockwise and anti clock-wise direction. Two push buttons are fitted on the LCP (local control panel) to rotate the motor and hence the OLTC contacts in clockwise and anti-clockwise direction. This movement of contacts thus controls the output LV voltage of the transformer. So rotating of OLTC contacts with spindle or push buttons in this way is a manual process. In case this process of rotating the OLTC contacts and hence controlling the LV side voltage is to be done automatically then a RTCC (Remote Tap Changer Controller) is installed with the transformer HT Panel. The RTCC sends signals to LCP and LCP in turn rotates the motor as per the signals received from the RTCC.

Automatic OLTC Panel consists of a LCP & a RTCC. System uses an AVR (AVR-MA9) to sense the LV voltage and a comparator circuit to compare the sensing voltage with a preset value. Any difference in two sends a corresponding signal to OLTC panel to lower or raise the LV voltage of transformer. The OLTC control panel also has the provision to operate two or more transformers in parallel. One transformer is taken as the master and the remaining as the followers

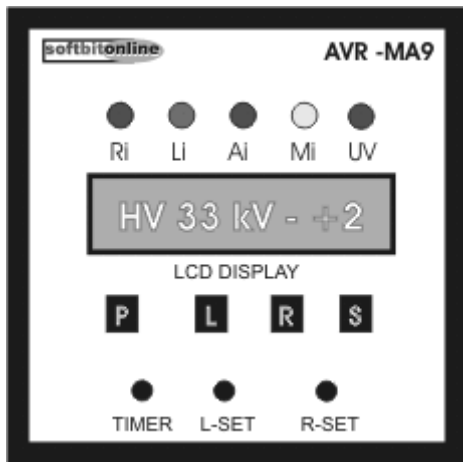
so that they follow the master's LV voltage set values.

An OLTC control panel is fitted with various indications to visually show the various operations being performed by the OLTC as forward and reverse movement of OLTC contacts, upper limit and lower limit indications, fault indications, interlocking indications between manual and automatic mode of the OLTC and many more.

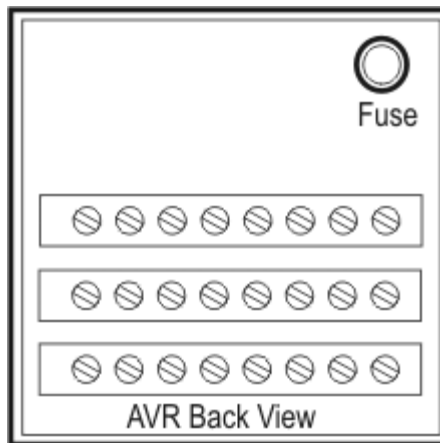
CHARACTERISTICS:-

- Wide Range
- Voltage Class 11kv, 22kv, 33kv, 66kv and 132 neutral end
- Current Rating up to 500 Amps
- Single phase off circuit Tapchanger upto 2000 Amps
- Type tested as per IS and IEC standards
- Tapchangers for Furnace application
- 6, 9, 10, 17, 21, positions
- Suitable for bidirectional power flow
- Supplied with Remote Tapchanger Control Cubicle
- Compatible for SCADA and computer controls

WORKING OF OLTC AVR-MA9:-



Dimensions: 96mm x 96mm x 165mm
Front View



Panel Cutout: 91mm x 91mm
Back View

RI	Raise Indicator
LI	Lower Indicator
AI	Auto Indicator
MI	Manual Indicator
UV	Under Voltage
P	Panel
L	Lower - Push
R	Raise - Push
S	Set
TIMER	Time Delay Control
L-SET	Lower Level Setting Control

The Automatic Voltage Regulator Relay - AVR-MA9, is a totally microprocessor based relay that controls the arm movement with the help of high torque motor (OLTC and motor are not parts of the AVR supply). It also indicates the line voltage, line current, load on the transformer, apparent and reactive powers, system frequency and power factor. The AVR can be set to "Auto" or "Manual" mode. In "Auto" mode the AVR controls and maintains the transformer LV voltage as per the pre set value automatically. It senses the variations in LV voltage for a pre-set time delay and brings the voltage to normal value by changing the tap position of OLTC with the help of high torque motor. In "Manual" mode the LV voltage can be controlled through low/high push buttons which are fitted along with OLTC - LCP (Local Control Panel). Up and down movement of OLTC motor is indicated with the glow of LEDs fitted on the AVR and on the OLTC - LCP. This AVR can be used with any type of OLTC as it has to control the movement of motor which is connected with the arm that moves the contacts of the OLTC. The LCP is generally fitted near the OLTC or upon the OLTC box while the RTCC is fitted with the HT panel of the transformer.

PC/Laptop Connectivity of OLTC-AVR:

The OLTC - AVR can be connected to a desktop - PC or a laptop through RS-485 communication port. The various functions of OLTC - AVR can be set from the PC/laptop and values recorded.

Over current Protection of OLTC-AVR:

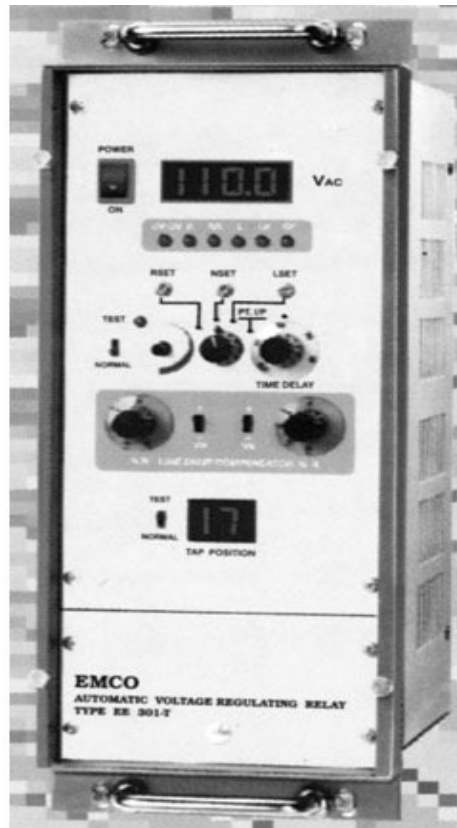
The OLTC - AVR is programmed to trigger an electromagnetic relay to activate an alarm in case there is a rapid voltage reduction in the system.

Parallel Mode of OLTC-AVR:

The OLTC - AVR group can operate more than one transformers in parallel mode through master-slave method.

AUTOMATIC VOLTAGE REGULATING RELAY

TYPE EE301-T



FEATURES:

- Digital Readout for PT Supply and Dead-Band Settings
- Solid State Circuitry
- Self-Test Facility
- LED Indicators for Raise, Lower Pre-signals and Undervoltage / Overvoltage and Relay Operation Conditions
- Separate Nominal Value and Bandwidth Settings
- Continuously adjustable Time Delay Setting
- Automatic Resetting after Voltage Correction
- Single Pulse Operation of Control Relays
- Control Fail Alarm Contacts with Internal Blocking
- Undervoltage / Overvoltage Alarm Contacts with Internal Blocking
- Built-In Tap Position Indicator upto 35 taps

EMCO Electronics offers an integrated automatic Voltage Regulating Relay, type EE-301T, designed for operational simplicity. It regulates the secondary voltage of

power transformers with on-load tap changers. The bandwidth control allows the dead band to be set in terms of raise and lower voltage limits around a particular nominal value with specified sensitivity. The time delay control allows the regulator to respond only to the voltage fluctuations lasting for periods greater than the selected time delay. Where the voltage correction requires more than one tap change, the time delay is re-initiated before further tap changes. No special provision is required to reset the time delay, which resets automatically after the voltage correction. Solid-state lamps (LEDs) indicate voltages outside the preset limits and control relay operations. Operation of the raise/lower control relays is automatically inhibited when the voltage falls below the specified undervoltage limit/goes above the over voltage limit. One pair of normally open relay contacts is provided to affect the tap changer raise and lower operations and to trigger an alarm in case of under voltage/overvoltage conditions. An alarm in the form of normally open contacts has been provided in the same cabinet in case of control failure, i.e., AVR relay continuously showing either 'L' or 'R' command for more than 15 minutes due to malfunctioning of AVR/OLTC/any other reason. An in-built tap position indicator is provided for indicating the tap number of power transformer with 1 kW step resistances for a maximum of 35 taps. 4-20 mA TPI output for Scada can be optionally provided in the same cabinet. For compensating line resistance and reactance at different load currents an optional line drop compensator can be provided in the same cabinet. An alarm in case of auxiliary supply failure can also be provided in the form of normally close contacts in the same cabinet.

FAMILIARIZATION WITH VARIOUS INDICATIONS AND CONTROLS

(A) INDICATIONS

1.	4x7 Segment display (AVR)	Displays light when auxiliary supply is on.
2.	2x7 Segment display (TPI)	Displays light when auxiliary supply is on.
3.	'L' Lamp	ON whenever the PT Voltage Exceeds the Lower Voltage set limit.
4.	'R' Lamp	ON whenever the PT Voltage falls below the Raise Voltage set limit.
5.	UV/OV Lamp	ON whenever the PT Voltage falls below the Factory set under voltage limit i.e. below 80% of the nominal voltage. This lamp will turn off only when the PT voltage raise above 80% of the nominal voltage value. This lamp will also get On when the PT Voltage goes above the factory

		set over voltage limit i.e. above 132V.this lamp will turn off only when the PT Voltage falls below 127V.
6.	'LR' Lamp	On when Lower relay is energized.
7.	'RR' Lamp	On when Raise relay is energized.
8.	CF Lamp	On when Control fail Relay is energized i.e. when the PT Voltage remains outside the bandwidth for more than 15 minutes.
9.	Test Lamp	ON when the AVR is in TEST Mode.

(B) CONTROLS

1. Power ON:-

This is a toggle switch which when ON supplies Auxiliary voltage to the instrument.

2. R-Set:-

This is a variable control varying from 0.5V to 5.0V below NVA setting. This control sets the lower limit of the PT Voltage below which if the voltage reduces, then corrective action will be taken by the instrument. The setting is to be read on display.

3. 'NOM' Set:-

This is a variable control to set the nominal value of PT voltage varying between $\pm 10\%$ of 110V. This setting becomes the reference level around which is to be read on the display.

4. 'L' Set:-

This is a variable control varying from 0.5V to 5.0V above NVA setting. This control sets the upper limit of the PT Voltage below which if the voltage reduces, then corrective action will be taken by the instrument. The setting is to be read on display.

5. Time Delay:-

Corrective action takes place only after the time delay as set by the control has elapsed and the PT Voltage continues to remain outside the set Lower or raise limits (but does not fall below the UV/OV limit)

6. TEST/NORMAL Switch:-

It selects the test or normal mode of operation. In the TEST mode, PT voltage is simulated internally and can be varied through the control on the front panel. A LED indication is provided to indicate that the instrument is in test mode. In the test mode the control relays are cutoff so that undesired operation OLTC is prevented during testing. The voltage is monitored on the display in PTI/P

position. In the NORMAL mode external PT voltage gets connected to the instrument this switch must be kept in normal mode when the instrument is in use.

7. TEST VOLTAGE CONTROL:-

Simulates PTI/P in test mode and can be varied from 0V to 150V AC.

8. TEST/NORMAL SWITCH for TPI:-

In the test mode display indicates '88' for checking the display. In the Normal Mode, it displays the actual tap no of OLTC. This switch must be kept in Normal Mode.

9. SELECTER SWITCH:-

It selects the voltage setting to be monitored on the display. It also enables the PT voltage to be read on the display.

(A)**Mechanical Damage:** Remove the front acrylic cover by removing the thumb screws and check for any mechanical damage to the unit.

(B)**Aux fuse and PT fuse (ON Rear Panel):** Aux Fuse is 300MA (20MM) & PT Fuse is 100MA (20MM) do not interchange the fuses. Check them and replace with good ones if required.

FUNCTIONAL DESCRIPTION OF VARIOUS MODULES

1. MAIN TRANSFORMER: This transformer is mounted on a plate towards the rear panel. This takes 230/110V AC and steps it down to 16V, 10V and 5V AC Voltage required for generating the power.

2. PT TRANSFORMER: This is also mounted on a plate towards the rear panel and steps down PT input from 110V AC to 3.3V AC which is used for sensing PT voltage.

3. MAIN PCB: This module generates $\pm 12V$ DC, +5V DC required to for circuit operation .Three pin regulator ICS 7812, 7912, 7805 are used to give regulated +12V,-12V and +5V DC Supplies. The PT input is step down in the ratio 110/3.3V. This stepped down voltage is rectified by a filter and amplified by IC 10 this voltage is used for comparison with reference voltage setting (on display PCB) L, R, UV/OV signals are received from display PCB.

4. DISPLAY PCB: R Set, Nom Set , L Set potentiometers allow the required settings to be set. The L, R, UV, OV settings are compared with the DC output by IC3 and the L, R, UV, OV LEDS indicate the relay operation condition. Time delay Potentiometer allows the required time delay to be set.

5. IC1 generates 15 minutes delay for CfR Condition which is indicated by CfR LED.

6. When LDC option is required %R & %X compensation SW3 & SW4 allows for polarity selection IC7 sums the PT I/P & LDC O/P.

7. TPI PCB: This PCB generates constant current which is used for generating 160mV per step. This IC2 is used to convert analog voltage to digital voltage and display the same on 7 segment display.

DIFFERENT FAULTS AND THEIR CAUSES:-

NATURE OF FAULT	PROBABLE CAUSES
Unit not switching ON.	Check Fuses Power On Switch connections to rear panel termination block OK. Check Mains Transformer and DC Voltages as per if faulty replace main PCB.
UV Indication Permanently ON.	Check PT Supply ,PT Fuse and Sense Transformer if all are OK then check DO/P Voltage TP9 on main PCB. If faulty replace main PCB else replace Display PCB.
Display reads 000 in all Position of selector Switch.	A to D Converter is faulty. Replace main PCB or else Display PCB.
L or R or UV/OV Indications not coming after varying PT Input beyond dead band setting..	IC3 on Display is faulty. Replace Display PCB.
LR or RR not coming after varying PTI/P voltage after the set time delay.	Digital circuitry on Main PCB faulty. Replace Main PCB.
LR or RR commands coming but OLTC not operating.	Check contacts on Rear Panel terminal block. If OK Check control panel wiring if contacts are not OK then replace main PCB
LR or RR commands remains ON permanently.	IC4 on Main PCB faulty .Replace Main PCB.

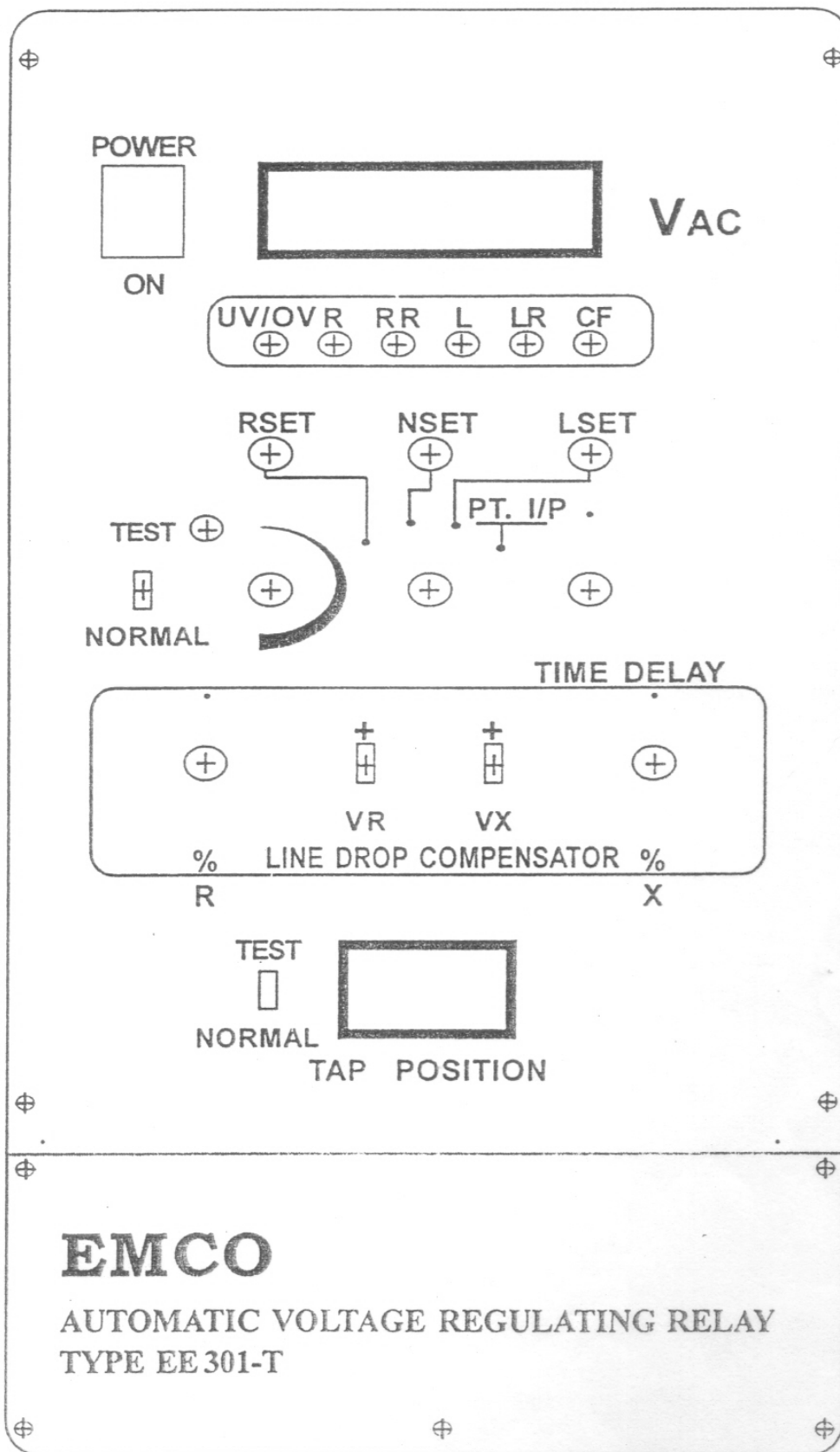
LINE DROP COMPENSATOR:-

Line drop compensators are used in load tap changing transformer and regulator control circuits to maintain a predetermined voltage at some point downstream from the regulated location. It is optional with Automatic voltage regulating relay type EE-301 T. The option is housed in the same enclosure. The voltages at the generating end and at the receiving end are not the same due to the drop across the line. The LDC is used to compensate for this line drop and the amount of compensation required is calculated as a% of the nominal voltage knowing the length of the line, its resistance/unit length, its reactance/unit length and the rated current and set on the front panel.

The line current is stepped down to 1A and fed to the LDC unit. The resistive and reactive drops are simulated by having 90° phase shifted voltage and their polarity is selected by polarity switches. The net compensation is then summed with the stepped down PT Voltage.

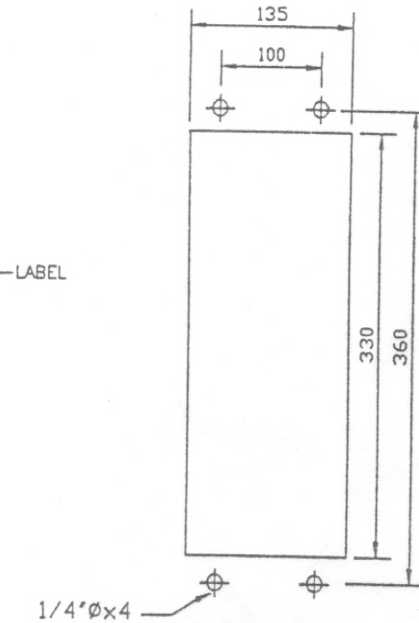
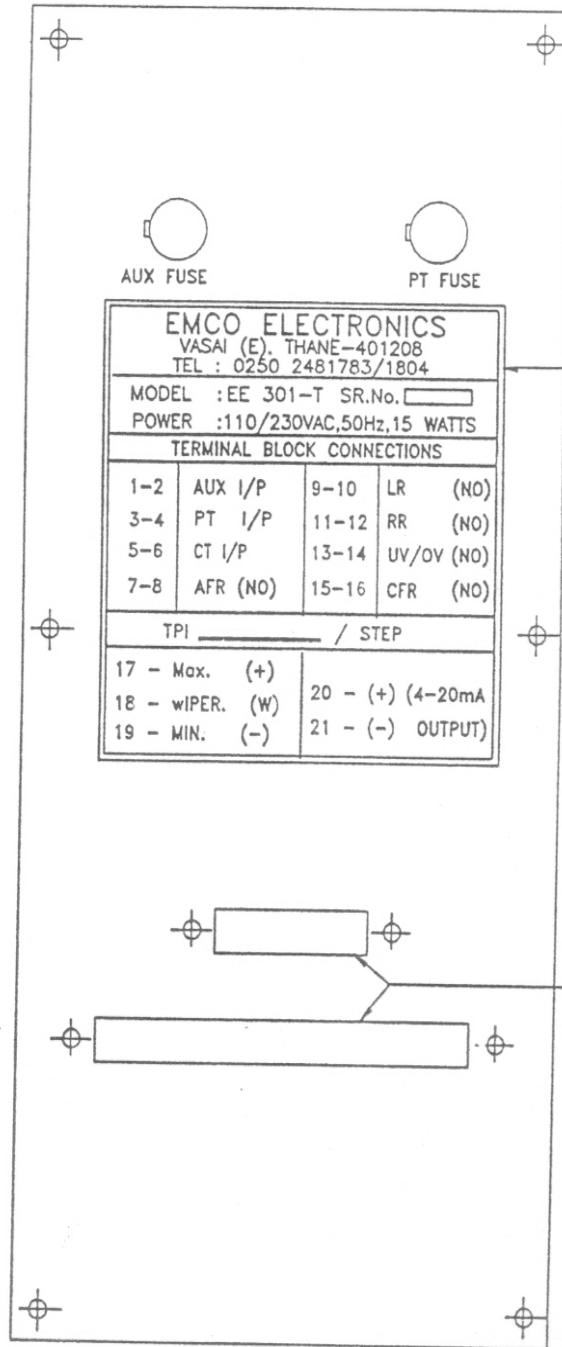
SPECIFICATIONS:-

Resistive and Reactive Compensation:	0-20% of the regulating value continuously adjustable.
Input Rated Current Power Consumption Accuracy:	1A, 50Hz, 5VA Max at 1A, 10%.
Maximum Over current Polarity selection:	50% of rated current (1.5 A).Both positive and negative compensation.



4			ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE	
3		PRODUCT : AVR (301-T)	EMCO ELECTRONICS	
2		ASSEMBLY:	TITLE : FRONT PANEL STICKER (BOTTOM)	
1		MATERIAL :	SCALE : N.T.S.	
ISS. DATE		APPR. BY	DRN. BY : J.J.P.	DATE : 9 - 4 - 03
		DRG. No. : 05-MD-19 / ISS.2		

FOR TOLERANCES NOT SPECIFIED REFER DIMENSION TOLERANCE CHART PD00-606



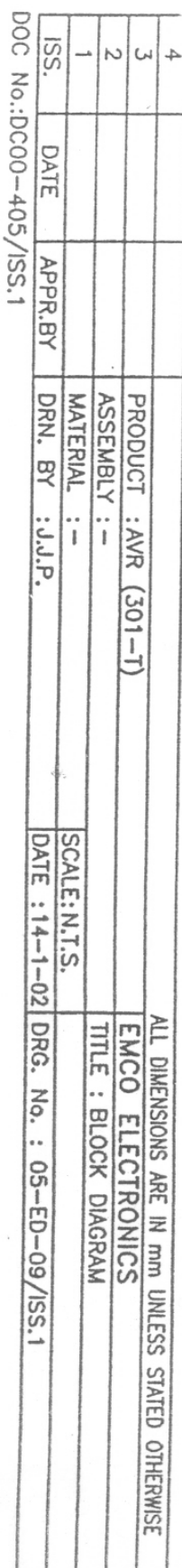
MOUNTING DETAILS

PANEL CUTOUT : 135mm x 330mm
 MOUNTING HOLES : 100mm x 360mm
 DEPTH : 260mm

REAR PANEL

4			ALL DIMENSIONS ARE IN mm UNLESS STATED OTHERWISE	
3		PRODUCT : AVR (301-T)	EMCO ELECTRONICS	
2		ASSEMBLY: -	TITLE : REAR PANEL WITH CUTOUT	
1		MATERIAL : -	SCALE: N.T.S.	DIMENSIONS & AVR CONNECTIONS
ISS. DATE	APPR. BY	DRN. BY : J.J.P.	DATE : 9-4-03	DRG. No. : 05-MD-20/ISS.2

DOC No. : DC00-405/ISS.1



DATE : 14-1-02	DRG. No. : 05-ED-09/ISS.1
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DRG. No. : 05-ED-09/ISS.1

AUTOMATIC VOLTAGE REGULATING RELAY

TYPE REG-DA:-



All measurement, control and regulation tasks of tap-changing transformers can be executed using the new REG-DA voltage regulator.

The REG-DA regulator features a world innovation as it is equipped with a high-capacity transformer monitoring function in accordance with CEI IEC 354 (VDE 0536). This function allows the operator to call up information about the hot-spot temperature and the lifetime consumption of the transformer at any time. If required, the regulator can even activate up to six cooling levels. The oil temperature can either be recorded directly (PT 100) or via a mA input.

Apart from its basic function, every REG-DA voltage regulator can be used as a measurement transducer, recorder, statistical unit, paramater and transformer monitor all at the same time. All important network measurement quantities are displayed in measurement transducer mode. The trends in the voltage that is to be regulated over time and a second, selectable, measurement quantity are shown in recorder mode. The statistical unit for the tap-change position offers a clear presentation of all switching operations of the tap changer. The paramater provides a complete busbar simulation.

Interconnection of multiple voltage regulators on a network enables the mutual exchange of data between regulators over long distances. Various communications methods can be used to transfer data. This allows monitoring of multiple transformers from a centralized control centre. Parallel connection of several transformers can be very easily implemented this way. Application-specific tasks can be implemented via freely programmable inputs and outputs. The REG-DA regulator is able to communicate with a control centre via all common scada protocols.

CHARACTERISTICS OF THE REG-DA VOLTAGE REGULATOR:-

- Large backlit LCD (128 x 128) with all important information (tap-changer position, voltage, etc.)
- Measuring functions (U, I, P, Q, S, $\cos \varphi$, φ , $I \sin \varphi$, f)
- Recorder functions (2-channel chart recorder)
- Statistics functions (records total number of switching operations, switching operations per tap)
- Event recorder (log book)
- Transformer monitoring functions incl. recording of the hot-spot temperature and lifetime consumption
- 14 (26) freely programmable binary inputs • 9 (21) freely programmable binary outputs
- Freely programmable analogue inputs or outputs (mA)
- Pt 100 direct input for RTD temp. probe (option) • Input for tap-potentiometer (200 Ω ...20k Ω total resistance, option)
- Control of three-winding transformers
- Control of phase-shifting transformers
- Limit value monitoring for all measurement quantities
- 4 freely programmable set-point values
- Programmable rated values of U and I
- Parametric software WinREG for setup, programming and display as well as for PC-based archiving and evaluation of the recorder data
- Simulation software REGSimTM for the simulation of any parallel operation, network and load situations
- Implementation of freely programmable control tasks through
- Peripheral bus RS 485 (COM3) for additional interface modules (ANA-D, BIN-D)
- ParaGramer function for the display and automation of any parallel connections with up to ten transformers
- UL-certification

ANNUNCIATOR (MICROWARN 0600):-



This is a modified version of earlier Microwarn 9600 model which has been discontinued. Microwarn O600 is now more compact than before with reduced depth. Also it can have 3 output relay for extra function. Microwarn 0600 consists of 3 basic sections:

1. The Power Pack
2. The CPU
3. The Facia

1. The Power Pack:-

The Microwarn 0600 is powered by a highly reliable and noise free, specially designed power supply. It converts the available power source (AC/DC voltage supply) into a regulated and filtered DC output, which is fed to the annunciator unit.

2. The CPU:-

This is the Central Processing Unit of Microwarn 0600 which scans and processes the incoming fault signals from the various potential free field contacts and drives the corresponding LED windows and the audible devices in order to announce the fault, according to the operating sequence selected.

3. The Facia:-

This section consists of facia windows illuminated by “Super Bright LEDs” on occurrence of any fault. The Super Bright LEDs ensure a long and absolutely maintenance free window life along with a good visibility, and have very low power consumption. NO/NC, T/NT or sequence selection DIP switches are located outside, hence programming is now possible without opening the

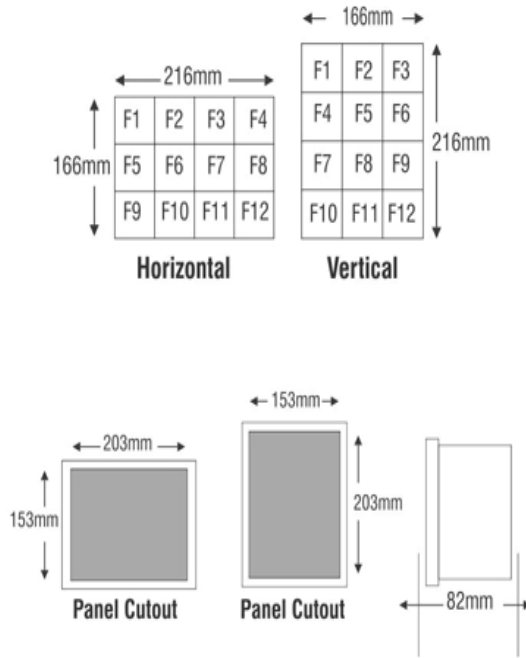
unit. Models of 12, 8, 6 windows are available. 8 and 6 window models are with built-in push buttons.

TECHNICAL SPECIFICATIONS:-

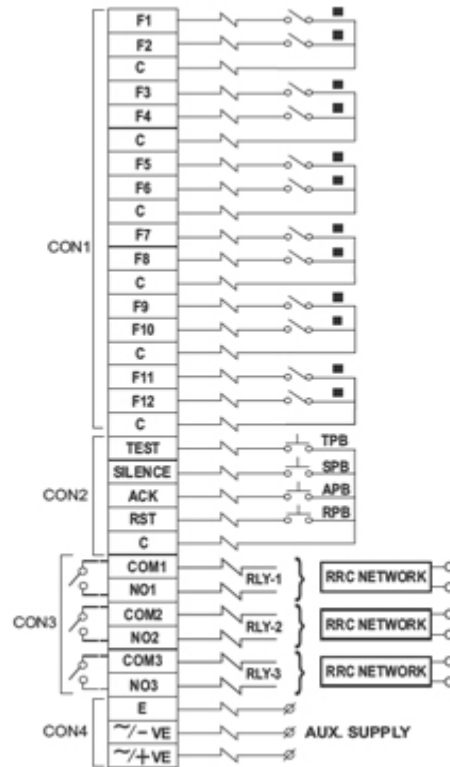
Supply Voltage	: 24/30/48/ V DC, 20-60 V AC/DC, 90-270V AC/DC
Windows	: 12/8/6
Window Sizes	: 45 x 45 mm
Display Device	: Super bright high efficiency low power consuming LED's
Facia Type	: Front Replaceable
Window/LED Colours	: Standard colour available RED, Optional colours Yellow / Amber, Green
Flash Rate	: Fast - 60 flashes/min. Slow - 30 flashes/min.
Response Time	: 40 msec.
Input Signal	: Potential free contacts (NO or NC site selectable)
Grouping	: site selectable (Trip / Non Trip)
Interrogation Voltage	: + 12 V DC
Output Contacts	: 1 NO + 1 NO (optional) + 1 NO
Architecture	: Integrated
Operational Sequences	: ISA Standards sequences - Site selectable - Auto/Manual/First-up/Ringback (optional) OR any other sequence on request
Operational Temp.	: -5° C to 60°C
Power Consumption	: 1.5 Watts per Window (Max.)
Optional	: AC-DC fail Annunciation
Dimensions (mm)	
Panel Cutout (L x W)	: 153 x 203
Overall (L x W x D)	: 166 x 216 x 82

Wherever not specified Contact Rating: 5A @ 230 V AC (resistive) * CE marked products available on request.

CONNECTION DIAGRAM:-



Dimensional Details



Typical Connection Diagram

APPLICATIONS:-

Suitable for Panels in Following Applications:

1. Suitable for Panels in Process Plants, Diesel Generator sets, Central Control Rooms etc.
2. C & R Panel.
3. Material handling Systems.