

(An ISO 9001:2015 Cert. Co.)

EMCO ELECTRONICS

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SERVING TRANSFORMER INDUSTRY

EMCO ELECTRONICS is an ISO 9001:2015 certified organisation engaged into designing, manufacturing and servicing of wide range of quality products having international standards & features for Electrical Measurement, Protection & Control of Power Transformers over more than 3 decades. Emco Electronics is also a Govt. of India recognized R&D center.

EMCO Electronics products are appreciated in terms of quality & reliability across the country & abroad for many years.

EMCO Electronics has complete range of products for Transformer Industry which includes

- 1] Transformer Monitoring System (Digital RTCC Panel)
- 2] Automatic Voltage Regulating Relays (AVRs) with RS-485 Comm, & IEC61850 Standard
- 31 Tap Position Indicators with SCADA compatibility(TPI)
- 4] Remote Oil & Winding Temperature Indicator (ROTI/RWTI)
- 53 Voltage Controllers for Servo Stabilisers
- **61** Parallel Control Unit (PCU) & Current Transducers
- 71 Temperature Scanner & Controller

EE supplies its products to many blue chip clients like ABB, Crompton Greaves, Voltamp, Tata Power, Reliance Infrastructure, Alstom, Areva, Schneider Electric, CTR, BEST, BHEL, Bharat Bijlee, Emco Transformers, Esennar Transformers, TARI, TELK, GE, CESC, Jindal & many more Transformer manufacturers, Electricity Boards and utility services in India & abroad.

Emco Electronics aims to provide solutions to power industry for Protection, Measurement, and control of all parameters of Transformers.



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QUALITY MANAG	EMENT SYSTEM
EMCO ELE	CTRONICS
13, Kedarnath, Tungares Sativali, Vasai (E	hwar Indi. Complex No. 1,), Thane – 401 208
Sc	ope
Design, Manufacture, Marketing Measurement & C	& Servicing of Electronics Test, Control Equipment
This is to certify that the Quality Management meets the re	t System of the above mentioned Organization equirement of
ISO 90	01:2015
MS: 08431110-2	23 November 2016
Certificate Number	Date of 2 rd Re-Certification
23 November 2016	22 November 2017 +
State of Cash resources Speed on betaat of OSS Continuation Services Pet Lik • Certificance is <u>Valid for 3 Years</u> (23-11-2016 to 22-11 Date of 2 nd Re-Certification. Upon Successful Surveillance Audit a New Certificate with an Extended be issued. OSS Certification Plot No. C-707, 3rd Floor, Palase Eats, Raughal Contended Accreditation by the Joint Accreditat rest interest.	A 2019) From the Completion of d Validity shall Services Pvt. Ltd. Dook, Soctor-7, Dearka, New Dethi - 110077, India Iffeation.cra Iffeation.cra ioo System of Australia and New Zealand craffrailitter

Quality Policy



EMCO ELECTRONICS

We believe Customer Satisfaction is above all.

We shall achieve this through

- Effectively implementing, maintaining and continual improvement of Quality Management System.
- Meeting Internal & External Customer's requirement on Quality, Performance and Delivery.
 - Cost reduction through New designs, Innovations & regular product upgradations.
 - Strict control of Processes to maintain the Quality of our products.
 - Excellent After Sales Support to our Customers.
 - Developing reliable suppliers to mutually beneficial relationship.

Mrs. IIa B. Gandhi C.E.O. Emco Electronics

Rev.: 02 Date : 01-08-2014

Transformer Monitoring System : model EE-101 (Digital RTCC Panel)



EMCO Electronics Transformer Monitoring System EE-101 is designed with high-end features for complete monitoring and control of Transformer and On Load Tap Changer. EE-101 is designed in 19" subrack for Rack mounting. 5.1" Graphics display with 16 Nos. of keys makes viewing and editing all parameters very easy. Actual status of Transformer at any instance can be known through Status LEDs. Programmable Inputs and Outputs make the customization of complete system a very easy task. International standard Communication protocols like IEC-61850 makes EE-101 a global product.

Features

Monitoring and Control of Transformer Parameters like

- > Voltage
- > Current
- > Tap Position
- > Temperature
- > Paralleling
- > Life Consumption
- > Data and Event logging
- > Log Backup
- > Freely programable Binary Input (BR, PRV, Lockout Relay Op. etc)
- > Freely programmable Binary Output
- > Freely programmable Analog Input (DGA, H2 etc)
- > Freely programmble Analog Output
- > Modbus Protocol for Communication
- > IEC61850 Protocol for Communication
- > IEC61850 Compliance tested from ERDA
- > Type Tests done from NABL certified Lab

Transformer Monitoring System : model EE-101 (Digital RTCC Panel)

- 5.1" Large Graphics display with 16 front keys for User friendly interface.
 - > Large display to monitor the values of most required parameters in a single view.
 > Large 16 Keys divided into 5 Shortcut keys, 5 Function Keys and 6
 - Parametering keys for user friendly interface and ease of parametering.
 - Status LEDs to indicate various states of Transformer and Controller.
 - > LED indications for various conditions of Transformer like
 - UV, OV, UC, OC etc
 - > LED indications for various conditions of TMS like Blocked condition, Tap open etc.
- Modbus, IEC-61850 Protocols for Communication.
 - > One RS-485 port or One Ethernet port available for
 - Modbus or IEC-61850 protocols respectively on the rear panel.
 - Event recording and Data logging of all required parameters.
 - > Data Logging of all important parameters like Voltage, Current, Tap, Temperature etc with programmable logging time.
- Portable Data Backup through SD Card.
- > Data Log and Event Log backup on SD card in ready to read Excel file.
- Direct keys for Auto/Manual, Local/Remote, Raise/Lower and Home screen.
- Five Function keys for easy editing of Parameters
- 19" Standard Subrack assembly for easy installation.
- Plugin type Rear panel Terminal block connectors for ease of wiring.
 - > Plugin type combicon connectors for easy wiring and installation.
- Programmable Analog Inputs and Outputs.
 - > Total of 28 freely programmable Analog Inputs and Total of 16 freely programmable outputs available.
 - > Dissolved Gas Analysis via 4-20mA Input like DGA and H2
 - > External Temperature, TPI, Oil Level etc. can be monitored via 4-20mA I/P
- Programmable Binary Inputs and Outputs.
 - Total of 32 freely programmable Binary Inputs and Total of 32 Binary outputs of which 9 freely programmble Binary outputs available.
- Parallel operation of Transformer using Master/Follower and Circulating Current Method.
 - > Independent Master Slave Follower scheme for parallel Transformer control.
 - > 2 Transformers in Master-Slave mode.
 - > 10 Transformers in Master-Follower mode.
 - > Circulating Current method for Parallel control of 2 Transformers.
- Life Time consumption of Transformer.
 - > Life Time Consumption of Transformer calculations available.
- Predictive mode for controlling Transformer Temperature.
- Cooling control with 6 level settings.
 - > 6 independent relays with individual set points for controlling the Temperature of Transformer.
- Voltage compensation using LDC and Z compensation.
- Load based and Time based Load Shedding.
- Universal Power supply.
- IEC-61850 Compliance test passed from ERDA.
- Type Tests like EMI, EMC etc done from NABL certified Lab.

Automatic Voltage Regulating Relay : EE-301E



EE-301E

Emco's Solid State Automatic Voltage Regulating Relay type EE-301E is designed for maximum operational simplicity. The bandwidth control allows the dead-band to be set in terms of upper and lower voltage limits. The time delay control allows the regulator to respond only to voltage fluctuations lasting for periods greater than the selected time delay. No special provisions are required to reset the time delay, which resets automatically after the voltage correction. Control pulses are blocked in UV condition.

Features

- Low cost AVR
- Digital readout for PT Supply and Dead band Settings
 LED indications for Raise, Lower presignals, Undervoltage
- and Control Relay operation conditions
- Continuously adjustable Time Delay Setting

- Automatic resetting after voltage correction
- Single pulse operation of control relays
- Undervoltage internal blocking

Control Relays

Control operation

Operating Temp.

Overall Dimensions

Panel Cutout

Weight

Option

- UV or Auxiliary Fail Relay optionally available
- 433V Display optionally available

Technical Specification

Auxiliary Supply	:	110/230V AC ±15%, 50Hz, 15VA
Lower Setting (LS)	:	Adjustable between 95V to 125V and readable on display
Raise Setting (RS)	:	Adjustable between 90V to 120V and readable on display
Time Delay Setting	:	Fixed (Voltage independent) Time Delay Continuously adjustable from 10 to 120 sec.
Time Delay Resetting	:	Instantaneous resetting with voltage deviation occurring in opposite direction
Undervoltage Blocking	:	Internal blocking at 80V, Restoration at 85V

: A pair of normally open potential free
contacts of rating 5A at 240V AC or 24V
DC resistive load for each Lower and
Raise contro <mark>l relays</mark>
: Single pulse operation with approx. 2 sec
ON Time

: 0°C to 45°C

: 92 mm (H) x 188 mm (W)

: 96 mm (H) x 192 mm (W) x 220 mm (D)

: 1.5Kgs. approx.

- : 1. 1 pair of NO contacts for UV or Auxiliary Fail
- 2. 433V Display
- 3. 230V PT input with continuous pulse

Automatic Voltage Regulating Relay with TPI : EE-301ET



EE-301ET

Emco's Solid State Automatic Voltage Regulating Relay type EE-301ET is designed for maximum operational simplicity. The bandwidth control allows the dead-band to be set in terms of upper and lower voltage limits. The time delay control allows the regulator to respond only to voltage fluctuations lasting for periods greater than the selected time delay. No special provisions are required to reset the time delay, which resets automatically after the voltage correction. Control pulses are blocked in UV condition.

In-built TPI avoids the need of separate TPI. It reduces the space, wiring and Time. Separate Power supply with separate Terminals are provided for the TPI.

Features

- AVR and TPI integrated in single unit
- Saving on Space and Wiring
- Automatic Detection of Max Tap
- User specified Step Resistance
- Digital readout for Tap No. with Adj. Pot
- Digital readout for PT supply and Control band settings
- LED indications for Raise, Lower, UV and Presignals
- Automatic resetting after Voltage correction
- Single pulse operation of Control Relays
- Undervoltage Internal Blocking
- 433V Display available (optional)

Technical Specifications

Auxiliary Supply	: 110/230V AC ± 15%, 50Hz, 10VA	UV Blocking	: Blocking at 80V and restoration at 85V
Max. No. of Taps	: 35 or user specified	Control Relays	: One pair of NO potential free
Step Res. / Tap	: 1KE or user specified		contacts of 5A at 240 <mark>V AC or 24V</mark>
PT Supply	: 110V AC, 50Hz, 1.5VA		DC for Raise and Lower
Lower Setting	: Adjustable between 95 to 125 V	Control Oper.	: Single Pulse operation with
Raise Setting	: Adjustable between 90 to 120 V		approx. 2 secs. ON time.
Time Delay Setting	: Adjustable between 10 to 120 Sec.: Immediate with voltage returning	Operating Temp.	: 0°C to 45°C
Time Delay Resetting		Overall Dim.	: 96 x 192 x 220 mm (H x W x D)
	to Control band	Panel Cutout Weight	: 92 x 188 mm (H x <mark>W)</mark> : 2 Kgs. (approx.)

Automatic Voltage Regulating Relay : EE-301M & EE-301T



Emco's solid state Automatic Voltage Regulating Relays are designed for maximum operational simplicity for regulating the secondary voltage of Power Transformers with OLTC. The Lower & Raise settings allow the dead band to be set as per requirement. The time delay control allows the regulator to respond only to voltage fluctuations lasting for periods greater than the set time delay. A pair of NO contacts is provided for operation of tap-changer after the set time delay is over.

Features

- Digital Readout for PT Supply and Deadband Setting
- Solid State Circuitry
- Self Test Facility
- LED Indicators for Raise, Lower pre-signal and Undervoltage / Overvoltage and Relay operation condition
- Separate Nominal value and Bandwidth settings
- Continuously adjustable Time Delay setting

Technical Specifications

- Automatic resetting after Voltage correction
- Single pulse operation of control relays
- Control Fail Alarm Contacts with Internal Blocking (optional in 301M)
- UV Alarm contacts with internal Blocking
- Optional Line Drop Compensation
- Integrated Tap Position Indicator in AVR EE-301T with optional 4-20mA output

Auxiliary Supply	: 110/230V AC ±15%, 50Hz, 15VA	Control operation	: Single pulse operation with ap
PT Supply	: 110V AC, 50Hz, 1.5VA and readable on		on time
	display	Operating Temp.	: 0°C - 45°C
Nominal Value Setting	: Adjustable between 110V ±10% and	Overall Dimensions	: 398 x 148 x 261 (HxWxD) mm
(NVA)	readable on display	Panel Cutout	: 330 x 135 (HxW) mm
Lower Volts Setting	: Adjustable between 0.5V to 5V above the NVA and readable on display	Weight	: 7 Kgs. (approx.)
Raise Volts Setting	: Adjustable between 0.5V to 5V below the NVA and readable on display	Options	: 1.Line Drop Compensator with and reactive compensation of
Time Delay Setting	: Fixed (Voltage independent) Time Delay adjustable from 10 to 120 sec.		polarity upto 2 <mark>0% and suitab</mark> operation with 1A, 5VA CT
Time Delay Resetting	: Instantaneous resetting with Voltage returning to deadband		2. Normally closed Auxiliary Su Relay contacts
Undervoltage Blocking	: Internal Blocking at 80% of regulated value and restoration at 85%		3. User defined settings for P.T Time delay, Undervoltage
Control Relays	: One pair of normally open potential free contacts of rating 5A at 240V AC or 24V DC for each Lower, Raise, Control Fail		4. Normally open Control Fail I Contacts in case of Control F (i.e. in case of continuous 'L'
	control relays (only one pair of contacts is available for either UV or OV)		5. 4-20mA I/P for setting NVA r

Additional Features in EE-301T

- Contacts in case of Control Failure (i.e. in case of continuous 'L' or 'R' Condition for more than 15 minutes) 5. 4-20mA I/P for setting NVA remotely
- Built-in TPI for maximum 35 Taps, 1K step resistance with optional 4-20mA O/P
- Control Fail Relay (CFR) option available as Standard Feature
- Over Voltage blocking at 132V & Restoration at 127V Common UV/OV Relay contacts for Blocking

: Single pulse operation with aprox. 2 sec.

: 1.Line Drop Compensator with resistive and reactive compensation of either polarity upto 20% and suitable for operation with 1A, 5VA CT

2. Normally closed Auxiliary Supply Fail

3. User defined settings for P.T. Supply, Time delay, Undervoltage

4. Normally open Control Fail Relay Alarm

Blocking

Automatic Voltage Regulating Relay : EE-302



Emco's Automatic Voltage Regulating Relay type EE-302 is a modular Microcontroller based relay used for regulating the secondary voltage of Power Transformers used with On-Load Tap Changer. The parameter settings are made through the front panel keyboard. Independent Time Delay settings for first control pulse and subsequent pulses, allows selection of continuous or pulse operation. Voltage can be displayed in volts, KV or % deviation. Load shedding switch connections are provided on the rear panel for reducing the Nominal Value by 3, 6 or 9%.

Features

- Microcontroller based architecture with A/D converter
- Keyboard entry for parameter settings
- Linear or Inverse Time response
- Two independent timers for first and subsequent pulses
- Single pulse or continuous pulse operation

Technical Specifications

Auxiliary Supply PT Supply Nominal Setting (NS) Lower Setting (LS) Raise Setting (RS) Time delay (T1) betn. deviation & 1st pulse Time delay (T2) betn. consecutive pulse UV Blocking OV detection

Primary Voltage (KV)

Control Fail Delay. Load shedding

Control Relays

110/230V AC ±15%, 50Hz, 15VA 110V AC, 50Hz, 1.5VA 85 to 140V in steps of 0.1 V +0.5 to +9% of NS in steps of 0.1% -0.5 to -9% of NS in steps of 0.1% 10 to 180 sec, Linear or Inverse response 0 to 11 sec, where 0 is continuous operation; 11 - T2 = T1 60 to 95% of NS in steps of 0.1% 105 to 130% of NS in steps of 0.1% with high speed return (2 sec ON / 2 sec OFF Control pulse) : 0-999.9 KV corresponding to NS in steps of 0.1KV 5 minutes fixed internally Nominal value reduced in steps of 3%, 6%, or 9% through external switch One pair of NO contacts of rating 5A at 240V AC or 24V DC resistive load for

each Lower, Raise, Control Fail, Undervoltage & Overvoltage Relays Readout of Pri. & Sec. voltages in V, KV and % Deviation
 Independent Lower & Raise settings in % of Nominal value

- Auto / Manual mode of operation
- High speed return for Overvoltage condition

Control operation

Panel Cutout Overall Dimensions Operating Temp. Weight Options Control pulse with approx. 2 sec.

268 x 12<mark>5 x (HxW) mm</mark>

268 x 165 x 340 (HxWxD) mm 0°C - 45°C

5Kgs. (approx.)

1.Line Drop Compensator with resistive and reactive compensation of either polarity upto 20% and suitable for operation with 1A, 5VA CT

2.Normally closed Auxiliary Supply Fail Relay contacts

- 3.Built-in Tap Position Indicator upto maximum 35 Taps with 1KE step resistance
- 4.Overcurrent Blocking @ 150% of rated current with a pair of NO contacts

AVR : EE-303 & EE-303C with IEC-61850 or MODBUS



(Modbus + IEC-61850)



(Communication + LDC)

Emco Electronics AVR EE-303C comes with Industry standard protocol like IEC-61850. It is a Microcontroller based Relay used for regulating the secondary voltage of Power Transformer using OLTC. Independent time delays can be set for first control pulse & subsequent pulses. Built-in TPI displays Tap no. of Power Transformer. In Manual mode, Tap Raise/Lower pulses can be given through the front panel switches. Test mode for self test of AVR, AVR Remote disable facility, Min, Max Voltage and Tap change count memory storage is available. RS-232 and RS-485 (MODBUS) communication facility is available in E-303C. Also Line Drop compensation is available in this model.

Features

- Microcontroller based architecture with A/D converter
- Built-in Tap Position Indicator up to 35 Taps
- Readout of Pri. & Sec. voltages and Tap No
- Two independent timers for first and subsequent pulses
- Independent Lower, Raise & Nominal value settings
- Linear or Inverse Time response
- Tap Change in Progress indication

- Blocking for UV, OV, CF & Max / Min Tap No.
- ✤ Auto / Manual mode of operation
- Test mode for testing AVR
- Minimum & Maximum PT Voltage & Tap Counter display
- Single pulse or continuous pulse operation
- RS232 & MODBUS Communication (in EE-303C)
- Remotely disabling of AVR

Technical Specifications

Auxiliary Supply PT Supply Nominal Setting (NS)	 110/230V AC ±15%, 50Hz, 15VA 110V AC, 50Hz, 1.5VA 85 to 140V in steps of 0.1 V 	Maximum Tap No. AVR Disable (Remote Operation)	 1 to 35 with 1KE/user defined step resistance I/P through potential free NO contact at remote end
Lower Setting (LS)	: +0.5 to +9% of NS in steps of 0.1%	Tap Change in	: I/P through potential free NO contact
Raise Setting (RS)	: -0.5 to -9% of NS in steps of 0.1%	Progress	from OLTC
UV Blocking	: 60 to 95% of NS in steps of 0.1%	TPI Input	: 1K step resistor chanin (35 Taps max.)
OV Blocking	: 105 to 130% of NS in steps of 0.1%	Relay Outputs	: 1 pair of NO contacts for Raise, Lower,
Primary Voltage (KV)	: 0-999.9 KV corresponding to NS in		UV, OV & CF
	steps of 0.1KV		1 pair of NC contacts for Manual mode
Time delay (T1) betn.	: 10 to 180 sec, Linear or Inverse	Control Pulse	: 2 seconds ON time
deviation & 1st pulse	Response	Contact Rating	:5A @ 240V AC or 24V DC
Time delay (T2) betn.	: 0 to 11 sec, where 0 is continuous	Operating Temp.	: 0°C to 45°C
consecutive pulse	operation; 11 - T2 = T1	Panel Cutout	:92 mm (H) x 18 <mark>8 mm (W)</mark>
Control Fail Delay	: 300 to 900 sec. in steps of 0.1 sec.	Overall size	: 96 x 192 x 220 mm (H x W x D)
Auto / Manual Mode	: Selects Auto or Manual mode of	Weight	: 3Kgs approx.
(A/M)	Operation		
Test mode	: Allows AVR to be tested for all conditions	Options	1. Auxiliary Fail Relay (NO Contacts)
	through indication by LEDs. Relay		2. 4-20mA TPI Output for SCADA
	contacts are blocked during TEST mode		3. Line Drop Compensation (LDC)

Additional features in EE-303C:

Communication

: 1. IEC-61850 Communication Protocol.

	UI UI
	2. 1 RS-232 port for Parameter Setting with computer software
	3. 1 RS-485 port for MODBUS Communication
Readable Parameters	: PT, KV, MIN, MAX, TAP No., TAP Count
Programmable Parameters	: NOM Vg, L Set (%), R Set (%), KV, UV (%), OV (%), T1 (S), T2 (S), CFR (S)
	Max. Tap, Oper. Mode (A/M), Timer Mode (L/I).
 Readable Parameters Programmable Parameters 	: PT, KV, MIN, MAX, TAP No., TAP Count : NOM Vg, L Set (%), R Set (%), KV, UV (%), OV (%), T1 (S), T2 (S), CFR (S Max. Tap, Oper. Mode (A/M), Timer Mode (L/I).

Tap Position Indicator : EE-601, EE-601W & EE-601S







EE-601S

EMCO's Tap Position Indicators are used to indicate the Tap position of the Power Transformer with On Load Tap-Changer (OLTC). The 3 wires coming from the OLTC (Min, Wiper, Max) are connected to the TPI along with the Auxiliary Supply. In case only 2 wires are available, short Wiper and Max terminals. As the tap of the Power Transformer changes, the display is updated. When the wiper is open the display indicates zero.

Features

- Microcontroller based architechture
- ✤ 2 digit, 7-seg LED, bright display
- Potentiometer provision for trimming to compensate the lead resistance
- Automatic detection of Max. Tap
- Robust & Rugged design
- Panel mounting with standard cutout (except 601W)
- Test mode for checking displays (except 601W)

Technical Specifications

Max. No. of tap positions	: 35 Taps
Step Resistance/Tap	: 1KE ± 1% or user defined
Display	: 2 Digit 7 segment LED
Test mode	: Display indicates 88 (EE-601 only)
Auxiliary Supply	: 95-260V AC/DC, 5VA
Overall Dimensions	: 96 x 96 x 132 mm (For EE-601), 96 x 48 x 132 mm (For EE-601S
	: 100 x 100 x 100 mm (For EE-601W)
Panel Cutout Dimensions	: 92 x 92 mm (For EE-601), 92 x 46 mm (For EE-601S)
	: 35mm Vertical Din-Rail / Wall Mounting (For EE-601W)
Depth	: 110 mm (EE-601, EE-601S) & 95mm for EE-601W
Operating temperature	: 0°C - 45°C
Weight	: 0.5 Kg. approx.
Options	: 1) 4-20 mA output for SCADA (not available in EE-601).
	2) 4-20 mA input instead of 3 wires resistance chain.

TPI with BCD O/P : TPI EE-611 TPI to BCD Transducer : EE-611BT

EMCO's TPIs are used to indicate the Tap position of the Power Transformer with OLTC. The 3 wires coming from the OLTC (Min, Wiper, Max) are connected to the TPI. As the Tap of the Transformer changes, the display is updated.



Technical Specifications

Max. No. of Taps	: 35 Taps
Step Resistance	: 1KE ± 1
Display	: 2 Digit 7
BCD O/P	: 2 digit P
	(4 + 2 R
Auxiliary Supply	: 95-260\

- 35 Taps.
 1KE ± 1% or user defined.
 2 Digit 7 seg. LED for TPI EE-611.
 2 digit Potential free NO contacts (4 + 2 Relays for Dig 1 + Dig 2 resp.)
 95-260V AC/DC, 5 VA.
- Mounting Overall Dim. Operating temp. Weight Options
- : 35mm Din-Rail / Wall Mounting. : 100 x 100 x 100 mm (H x W x D).
- : 0°C- 45°C.
- : 0.5 Kg<mark>. approx.</mark>
- : 1) Dual 4-20 mA output.
- 2) 4-20 mA input.

Tap Position Indicator : EE-607 & EE-601G







EE-601G

EMCO's Tap Position Indicator Type EE-607 / EE-601G is used to indicate the tap position of the Power Transformer. 6 digit BCD / Gray code along with Ground as Common as marked on the rear panel A1 (LSB) to A5 (MSB for Gray code type) or A6 (MSB for BCD Code type) is connected to the input of TPI. The corresponding tap no. is indicated on the display.

Features

- Microcontroller based architechture
- 6 digit BCD Code Input with Com (EE-607)
- ✤ 5 digit Gray Code Input with Com (EE-601G)
- 95 to 260 V AC/DC Universal Power Supply
- Small size, saves space on panel
- Bright and clear 7-segment displays

Technical Specifications

Max. No. of tap positions Display	: 33 for EE-607, 17 for EE-607 with 4-20mA O/P and 21 for EE-601G : 7 segment LED
Auxiliary Supply	: 110 / 230 V AC ± 10%, 50 Hz, 5VA
Overall Dimensions	: 96 x 48 x 132 mm (H x W x D) for EE-607 and EE-601G, 96 x 96 x 132mm (H x W x D) for EE-607 with 4-20mA Output option.
Panel Cutout Dimensions	: 92 x 46 mm (W x H) for EE-607 & EE-601G and 92 x 92 (W x H) for EE-607 with 4-20mA O/P.
Depth	: 110 mm
Operating temperature	: 0°C - 45° C
Weight	: 0.5 Kg. approx.

Tap Position Indicator : TPI EE-610



TPI Standard



TPI with Counter & Alarm



TPI with Dual 4-20mA Output



TPI with KV Voltage Display



TPI with Tap Change Counter



TPI with Counter, Vg. Dis. & 485 Communication

EMCO's Tap Position Indicators are used to indicate the Tap position of the Power Transformer with OLTC. The 3 wires coming from the OLTC (Min, Wiper, Max) are connected to the TPI. As the Tap of the Transformer changes, the display is updated.

Features

- Microcontroller based compact design
- Automatic Max. Tap detection and 4-20mA O/P adjustment
- Dual 4-20mA Output
- User programmable delay
- Digital calibration of 4-20mA Output

Technical Specifications

Max. No. of tap positions Step Resistance/Tap Current Output	 35 Taps or user specified 1KE ± 1% or user defined Dual 4-20mA Current Output 	Op. temp. Weight Options	: 0°C- 45°C : 0.5 Kg. approx. : 1) Tap change Counter.
Display	: 2 Digit 7 segment LED		2) Tap change Counter with Alarm contact
	(add. 6 digits in Counter		3) HV side KV Voltage display.
	or Voltage display unit & add.		4) RS-485 MODBUS Communication.
	12 digits in All options unit)		4) All Option : includes TPI + Tap Change counter +
Auxiliary Supply	: 95-260V AC/DC, 5VA		KV Display + Communication.
Overall Dimensions	: 96 x 96 x 132 mm (H x W x D)		Note : Alarm contact is not available in All Option.
Panel Cutout Dimensions	: 92 x 92 mm		5) 4-20 mA input instead of 3 wires resistance chain.
Type Tests	: EMI/EMC Type tested from NABL accredited Lab.		6) Dual chain I/P with selection.

- Tap change counter (optional)
- Alarm relay at predefined count (optional) ***
- HV side KV display (optional)
- RS-485 MODBUS Communication (optional) ***
- ** 4-20mA or 0-20mA Input (optional)

Remote Temperature Indicator : EE-602



EMCO's ROTI / RWTI EE-602 are remote temperature indicators which indicate temperature proportional to resistance input. The temperature is indicated on a 3 digit 7 segment LED display. The 3 wires viz Min., Max., and Com. coming from 440E or 2K8 pot within the main analog type OTI / WTI are connected to Min., Max. and Com. Terminals on the unit as indicated on the rear panel. Test / Normal switch is used for testing the display.

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Features

- Microcontroller based circuitry
- * 3 digit 7-segment display
- ** Standard panel cutout

Technical Specifications

Input Resistance Temperature Range Accuracy Display Auxiliary Supply Dimensions

: 0 to 440 / 2.8KE ± 1% or as specified : 0°C to 150°C : ± 2°C : 3 digit 7 segment LED display : 95-260V AČ/DC. 5VA : 96 x 96 x 132 mm (H x W X D)

Panel Cutout Operating Temp. Weight Options

4-20mA output or input (optional)

Full scale adjustment facility

Universal Power Supply

- : 92 x 92 mm (H x W)
- : 0°C to 45°C
- : 0.5Kg. approx.
- : 1) PT-100 Sensor Input 2) 4-20mA input
- 3) 4-20mA output for SCADA

Transmitter: EE-701

EMCO's Transmitter is used for transmitting Tap Position number or Oil / Winding temperature via 4-20 mA output. The connections from the minimum, maximum and wiper positions coming from the Tap-changer or OTI / WTI are connected to the respective Min, Max and Wiper terminals marked on the Transmitter. Universal Power Supply (95V to 260V AC/DC) is connected to the terminals marked on the Transmitter. When the unit is powered on, user can get the DC current output of 4-20mA corresponding to the tap number or Oil / Winding Temperature with load impedance of 100 ohms. The maximum Tap or Temperature value corresponds to 20 mA and the minimum Tap or Temperature value corresponds to 4 mA. Transmitter EE-701 consists of dual 4-20 mA current outputs.



Features

- 4-20 mA output for SCADA.
- Din rail / wall mounting. **
- ** Universal Power supply

Technical Specifications

Max. No. of tap positions I/P Step resistance / tap (TPI) Resistance I/P (ROTI/RWTI) Output

- : 35 Taps or user specified.
- : 1KE ± 1% or user specified.
- : 0 to 440E / 2.8KE
- : 4-20mA dc (4mA corresponds to Min value & 20mA corresponds to max value)

Power Consumption Overall Dim. Mounting Operating temperature Weight

3 Terminal input from OLTC or from OTI / WTI

Compact & light weight

95-260V AC/DC, 5VA 100 x 100 x 100 mm (HxWxD) 35mm Din rail mounting 0°C - 45°C 0.5 Kg. approx.

Transformer Temperature Monitor & Controller : EE-802



EE-802

EMCO's Oil and Winding Temperature Controller EE-802 is a combined Oil and Winding Temperature Indicator cum Controller that replaces traditional Analog type Oil and Winding Temperature Controller in the Marshalling box. It saves on both **Cost** and **Space** since it has both OTI and WTI integrated in one unit. It also requires much less efforts in wiring. It accepts PT-100 Sensor for OTI and 5A Current for WTI as inputs. OTI indicates the actual oil temperature whereas WTI indicates simulated temperature based on Oil temperature and gradient as per the current through C.T. It provides 4 relays for controlling Fan, Cooler 1, Cooler 2 and Trip with individual set points for each OTI and WTI. It also provides dual 4-20mA outputs for OTI and WTI each. These outputs can be used for Remote indication and SCADA connectivity.

Features

- Microcontroller based circuit
- Integrated Oil and Winding Temperature Controller
- Digital readout of Oil and Winding Temperature
- Replaces Analog type Controllers
- 4 set points viz Alarm, Cooler 1, Cooler 2 and Trip for Oil and Winding each
- Dual 4-20mA Output for Oil and Winding each
- Programmable C.T. Current and Gradient Temp. for Winding
- Maximum Temperature recording and reset
- Highly accurate and reliable
- Rigid and Sturdy design

Technical Specifications

Aux. Supply	95-260V AC/DC, 10 VA	Max. Current : 6/	A (max)
Display	Dual 4 digit, 7-seg. LED	Temp. Grad.	5°C (max)
Temp. Range	0°C to 150°C	Delay : 0	to 60 Secs.
Resolution	0.1°C	Hysterisis : 0	to 20°C
Accuracy	± 2°C	Set Points & : 0°	°C to 150°C settable for Fan
Inputs	PT-100 Sensor & C.T.	Ctrl. Relays C	ooler 1, Cooler <mark>2, Trip</mark>
Outputs	Dual 4-20mA for OTI	Contact Rating : 5/	A @ 230V AC <mark>/ 24V DC</mark>
	& WTI each.	Enclosure : Pi	rojection type, Metallic
Control	4 Control Relays with	Overall size : 2	265 x 215 x 1 <mark>10 mm ± 5 (W x H x D)</mark>
	individual setpoints	Mounting : 2	235 ± 5 x 15 <mark>0 ± 5 mm (W x H)</mark>

TESCON : Temperature Scanner and Controller EE-803





EE-803

EMCO's Transformer Temperature Scanner and Controller Type EE-803 is used for monitoring and controlling the Temperature of Transformers. It has 4/8 No. of Input Channels that are isolated from each other and can be used with different types of sensors like RTD PT-100 and Thermocouples of K,J,R & S types. There are 4 Control Relays with individual Set points. All the parameters are adjustable through front keys. Modbus protocol is available for communication. Dual 4-20mA Outputs are available for retransmission. Scan / Hold mode of operation is provided for easy monitoring of particular channel.

Features

- ✤ 4/8 channel, Microcontroller based Temperature indicator and controller
- Universal type Input Channels.
- Input Sensor selection, Range selection.
- Ch. Skip/Hold with Auto/Man scanning
- ✤ Adjustable Scan Time

- Sensor I/P and 4-20mA O/P Calibration
- Scan / Hold mode of display
- RS-485 Modbus Protocol
- Programmable parameters through keys
- ✤ 4 Relay outputs with channel grouping
- Dual 4-20mA Outputs

Technical Specifications

Max. No. of Channels Sensor Type	: 4/8 Input Channel with Channel skip. : PT-100, Thermocouple J,K,R,S with selection via keys.	RTC Communication Analog Output	: RTC with Battery Backup : RS-485 with Modbus RTU Protocol : 2 Nos. of 4-20mA Output for any ch.
Temperature Range	: RTD PT-100 : -99°C to 400°C		with 2 point calibration.
(selectable)	Themocouple J type : 0°C to 750°C Themocouple K type : 0°C to 1350°C	Input/Output Terminals	: I/P ter.: 1.5 sq. mm wire (metal type) & 2.5 sq. mm. wire (plastic type) and O/P ter.: 2.5 sq. mm wire
	Themocouple R,S type : 0°C to 1750°C	Auxiliary Supply	: 95-260V AC/ <mark>DC, 15VA</mark>
Resolution	: RTD PT-100 : 1°C or 0.1°C	Overall Dim. (Metal)	: 265 x 215 x 110 ± 5 mm (W x H x D)
	Themocouple K,J,R,S type : 1°C	Overall Dim. (Plastic)	: 96 x 96 x 17 <mark>5 ± 2 mm (W x H x D)</mark>
Accuracy	: Better than ± 1% of Full Scale	Mounting Dim. (Metal)	: Wall mounting by 3 Nos. M6 Screws
Compensation	: Auto. Cold Junction Compensation		235 ± 5 x 150 ± 5 mm (W x H)
Scan Mode	: Auto or Manual mode of Scanning	Panel Cutout (Plastic)	: 92 x 92 mm (W x H)
Adjustable Time Delay	: Selectable Scan and Log Time	Operating Temperature	: 0°C - 45°C.
LED Indications	: 4/8 Nos for Ch. Foult and	Enclosure (Metal)	: IP55 tested MS powder coated.
	4 nos, for Relay status	Enclosure (Plastic)	: ABS material standard enclosure.
No. of Relays	: 4 Relays with Relay grouping		

Voltage Controller for Servo Stabilizer : EE-401



The Voltage Controller Control Unit (VCCU) senses the output voltage of the Voltage Stabilizer (230 V AC) and controls it within the set limits. There are two independent "Raise" / "Lower" Voltage settings. When the output voltage goes outside the set limits the output "Raise" / "Lower" Pulse is given after the set delay is over. LED indication is provided to indicate the control action and a pair of NO contacts for Raise/Lower closes depending on whether the voltage has to be Raised or Lowered. Provision for setting Undervoltage (UV) and Overvoltage (OV) limits is also available. A pair of C/O contacts is provided for UV & OV. A hysteresis of approximately 1V is provided for Raise & Lower & 5V for UV & OV.

Features

- Independent Raise/Lower settings.
- Variable Time Delay settings..
- Projection / Wall Mounting.

Technical Specifications

Auxiliary Supply Raise Setting Lower Setting Undervoltage Setting Overvoltage Setting Time Delay Setting Output Contacts

Operating Temperature Overall Size Mounting Weight

- Independent Undervoltage & Overvoltage settings for cut off.
- LED Indication for Raise, Lower, UV, OV & Time Delay Operations.

- Adjustable from 200V to 250V Adjustable from 180V to 230V Adjustable from 220V to 260V
- Adjustable from 0.1 to 2.5sec

230V AC ±10%, 50Hz, 5VA

Adjustable from 200V to 250V

- 1 pair of (NO) contacts each for Raise & Lower with 5A@ 240VAC or 24VDC contact rating. 1 pair of C/O contacts for UV & OV with same rating
 0°C to 45°C
 96mm X 96mm X 132mm (H X W X D)
 - 122 x 62 (H x W) (Wall mounting)
 - 2Kg (approx.)

Parallel Control Unit : EE-501



EE-501

The Parallel Control Unit (PCU) is used for controlling 2 Transformers in parallel. Raise & Lower contacts from AVR1 & AVR2 are connected to PCU, and the outputs from PCU are connected to OLTC1 & OLTC2. Switches on the front panel allows selecting AVR1 or AVR2 as master & the other as follower, or both as masters (independent). Selecting both AVRs as follower will block the PCU. In the Manual mode of operation, PCU is blocked i.e. no output pulses are given. External A/M switch (NO contacts) are sensed for determining Auto / Manual mode of operation. Tap number of both Transformers are displayed on PCU. In Master - Follower mode the tap no. of Follower is made equal to the tap no. of Master. If the Tap nos. of both the Transformers are unequal for more then 5 mins, out of step indication is given & a pair of NO contacts closes. In this condition, both the OLTCs are blocked

Features

- Microcontroller based circuit
- Built-in Tap Position Indicators for both Transformers
- 4-20mA output for both Tap Position Indicators
- Selectable delay between Master and Follower pulses
- Switch selectable mode of operation (Master / Follower)
- Out of step indication and blocking
- Bus Coupler closure indication
- Minimum / Maximum Tap blocking
- Manual mode indication

Technical Specifications

Auxiliary Supply Maximum Tap No. Time delay between Master & Follower Pulse Modes of Operation

Overall Size Panel Cutout Weight

Inputs

Auto / Manual Raise & Lower Input Pulses Tap Position Indicators Bus Coupler Input

Outputs

Raise / Lower Pulses Out of Step condition Bus Coupler Output 4-20 mA outputs for TPIs : 110/230V AC ±10%, 50Hz, 15VA : 21 (or as specified)

: Settable between 10 to 150 secs

: Selected through Front Panel Switches

- ↓↓ Independent AVRs
 - AVR1 Master, AVR2 Follower
 - AVR1 Follower, AVR2 Master
 - PCU Blocked

: 96mm X 192mm X 220mm (H X W X D) : 92mm X188mm (H X W) : 2Kg (approx.)

: External (NO) potential free contacts : (NO) potential free contacts from AVR1 & AVR2 : Max, Wiper & Min wires from both OLTCs

: (NO) potential free contacts from Bus Coupler

2 sec ON-Time pulse with LED indication for both Transformers
LED indication with 1 pair of (NO) contacts
A pair of (NO) contacts for indicating Bus Coupler Closure
4-20 mA DC output for both TPIs

Tap Changer Controller : EE-901



Emco Electronics "Tap Changer Controller : EE-901" is integrated AVR and TPI with direct OLTC Motor drive. It accepts single phase or Three phase as PT Input for Voltage Regulation and accepts potential free contact for each Tap for detection instead of Resistive 3-wire input. 3-Phase input with setable Nominal setting. On the output side, it provides BCD output for each Tap with individual potential free contact for each Tap. LR and RR contacts for driving the OLTC motor directly without contactor. Auto/Manual and Remote/Local mode of operation and many other features to make the complete system fully user friendly and customizable to one's need.

Features

- Microcontroller based architecture
- Direct OLTC motor drive without contactor
- Single phase or 3 phase PT Input
- PT and Tap No. readout on display
- In-built Tap Counter for No. of Tap change monitoring
- Potential free contact available for each Tap
- BCD output available for each Tap
- Auto/Manual mode of operation
- Local/Remote mode of operation
- ✤ 4-20mA Output for Tap No. available

Technical Specifications

Auxiliary Supply	: 95-260V AC/DC, 15VA (1Ø) /	Command Relays	:LR and RR Rel <mark>ays drive motor directly</mark>
	: 350-440V AC/DC, 15VA (3Ø)	TPI Relays	: Potential free contact output for each Tap
PT Input	: 0-500V	TPI BCD Relays	: 4 Relays for BCD output for TPI
Set Voltage	: 85 to 460V	Retransmission O/P	: 4-20mA Output for TPI
Control Band	: ±0.5% to 9%	Remote Input	: LR, RR and Stop command through remote
Delay	: 5 Secs to 180 Secs		potential free contacts
UV Blocking	: 70% of Set Voltage	Operating modes	: Auto or Manual mode
UV Restoration	: 75% of Set Voltage	Connectors	: 19 core cable with round connector from
OV Blocking	110% of Set Voltage		OLTC for TPI and Raise and Lower command
OV Restoration	: 109% of Set Voltage	Operating Temp.	: 0 to 50 deg. C
Мах Тар	: 1 - 9 Taps	Overall Size	: 220 x 105 x 242 mm (W x H x D)
Tap Counter	: upto 65535 (Not resetable with test count)	Panel Cutout	: 210 x 96 mm (W x H)
Limit indicators	: Min and Max indications for TPI	Weight	: 2Kgs. approx.

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