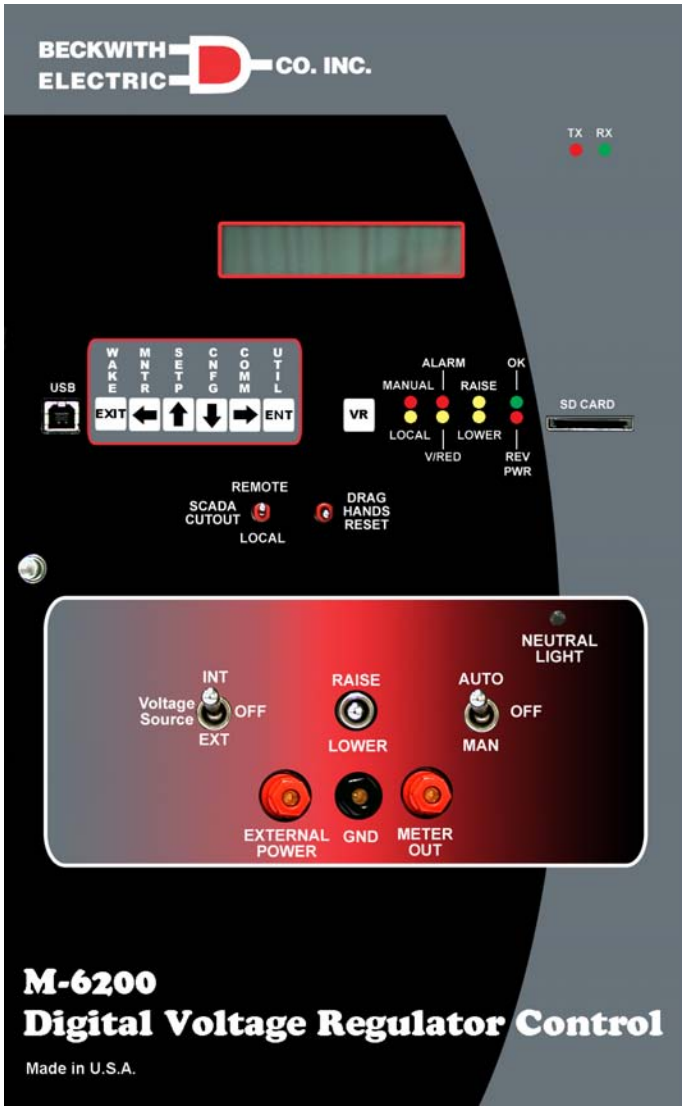
Digital Regulator Control M-6200

Digital Regulator Control for General Electric, Siemens, Cooper and Howard Regulators



Features

- Conventional and Autodaptive (Phase II) Control Methods
- Adjustable Bandcenter
- Adjustable Bandwidth
- Line Drop Compensation, R, X and Z Compensation
- Time Delay, Definite and Inverse
- InterTap Time Delay
- Selectable Outputs, Continuous or Pulsed
- Reverse Power Operation for Single-Phase Regulator applications
- Real-Time Metering of measured and calculated parameters
- Demand Metering with selectable time interval
- Drag Hands Operation
- Adjustable Line Overcurrent Tapchange Inhibit
- Voltage Limits
- Tap Position Limits
- Auto Runback (due to overvoltage)
- Three independent Voltage Reduction Steps
- Sequential and Non-Sequential Operation
- VT Ratio Correction
- Tap Position Knowledge by "Keep Track" method
- Operations Counter
- Resettable Operations Counter
- Harmonic Analysis (Phase II)
- Tap Position Record
- Auto/Off/Manual Switch Status
- A or B Regulator Type Selection
- User Programmable Alarm/Deadman Contact
- SCADA Cutout (Local/Remote) switch allows blocking of SCADA commands
- Control Voltage Input
- Source Side PT Input (Phase II)
- Motor Power Input
- Line Current Input
- Raise Output
- Lower Output
- 20 Character by 2 Row LED backlit LCD Display
- TapTalk® S-6200 Communications Software
- USB (2.0) Communications Port
- VAr Bias (Phase II)
- SD Card Slot
- Sequence of Events (SOE) (Phase II)
- Data Logging
- Oscillography (Phase II)
- External Inhibit of Auto Tapchange
- Front Panel LEDs for Out-of-Band **Raise**, Out-of-Band **Lower**, Reverse Power Flow **Rev Pwr** Detected, CPU **OK**, **MANUAL**, **LOCAL**, Voltage Reduction **V/RED** in Effect, **ALARM** and **TX/RX** COM1 Transmit/Receive
- Voltage Reduction 1 & 2 Inputs (Binary)
- Neutral Position Detect
- Counter Input (Binary)
- Motor Seal-in Input (Binary)
- Non-Sequential Input (Binary)
- COM1, RS-485 (two-wire)
- Fiber Optic Port
- Communication Protocols include MODBUS and DNP3.0
- Control Power Back-Up Input – input (+12 V dc) for backup of Fiber Optic loop-through communication
- One set (3) of spare fuses are included (B1163)

Optional Features

- SCAMP™ (SCADA Controllable Auto/Manual Pushbutton)
- Ethernet Port (Phase II) (10/100 Mpbs) is available through an RJ-45 jack. This port supports DNP over TCP/IP, MODBUS over TCP/IP, and IEC-61850 over TCP/IP
- RS-232 Communications Port (Phase II)
- Local Wireless Bluetooth capability (Phase II)

Accessories

- M-2026 AC-DC Control Power Backup Supply
- M-2027 Control Power Backup Supply–AC Only
- B-0920 Control Power Backup Harness

Software Selection of Conventional Tap-change algorithm and Autodaptive® Tap-change algorithm.

Conventional Mode Settings

Bandcenter: Adjustable from 100 V to 135 V in 0.1 V increments.

Bandwidth: Adjustable from 1 V to 10 V in 0.1 V increments.

Line Drop Compensation: R and X compensation. Adjustable from –24 V to +24 V in 1 V increments. Z compensation available with adjustment of voltage raise from 0 V to +24 V, in increments of 1 V.

Time Delay: Definite; adjustable from 1 second to 120 seconds, in 1 second increments. Inverse; adjustable from 1 second to 120 seconds, in 1 second increments.

InterTap Time Delay: Used to introduce time delay between tap operations when control is in sequential mode; adjustable from 0 to 60 seconds in 1.0 second increments. Counter input required.

Selectable Outputs: Continuous or pulsed. Normally, an output (raise or lower) signal is maintained when the voltage remains outside the band. A pulsed output length is programmable from 0.2 to 12 seconds, in increments of 0.1 second.

Reverse Power Operation: If "keep track" tap position indication is applicable, unit may be set to "Return to Neutral", “Ignore”, “Block” or “Regulate in Reverse”. The Regulate Reverse feature allows separate setpoints and regulation in the reverse direction without the installation of source-side VTs. If “Keep Track” is disabled, then only “Ignore” and “Block” modes are available.

CT to VT Phasing Correction: Adjustable from 0° to +330° in 30° increments.

Line Overcurrent Tapchange Inhibit: Adjustable from 200 mA to 640 mA of line current for 200 mA CT.

Voltage Limits, Tap Position Limits, and Runback: Overvoltage and Undervoltage limits are independently adjustable from 95 V to 135 V in 0.1 V increments. Upper and lower tap position limits may be set by user, with tap position knowledge active. An adjustable deadband (above the overvoltage limit) of 1 V to 4 V is available, which is used to set the runback limit.

Voltage Reduction: Three independent steps, each adjustable from 0% to 10% in 0.1% increments of the bandcenter setpoint.

Inhibit of Auto Tapchange: Blocks automatic regulator operation in response to external contact closure or software setting.

Sequential or Non-Sequential Operation: Non-sequential operation resets the time delay upon momentary external contact closure at the non-sequential input.

VT Ratio Correction: VT correction from –15 V to +15 V in 0.1 V increments.

User-Programmable Alarm/Self Test Contact: Alerts operator to one or more of the following system conditions: Communications Block Invoked, Block Raise Voltage Limit Exceeded, Block Lower Voltage Limit Exceeded, Voltage Reduction (any step) Invoked, Reverse Power Flow Condition Detected, Line Current Limit Exceeded, Tap Block Raise in Effect, Tap Block Lower in Effect, Seltest (Deadman) and LDC/LDZ.

Tap Position Knowledge
In most applications, tap position information can be maintained by means of an internal "keep track" logic.

Operations Counter: A software counter increments by one count per either an open/close/open contact operation (X1) or an open/close or close/open contact operation (X2), and is preset by the user. A count window mode registers any activity as a valid input within the count window time setting.

Resettable Operations Counter: A second software counter, similar to the operations counter, which may be reset by the user.

Harmonic Analysis: Provides the total harmonic distortion and the harmonic content of the load voltage and current up to the 31st harmonic (using TapTalk).

Tap Position Record: Provides a record of the number of times each tap position has been passed through (using TapTalk). The tap position record can be reset by the user.

AUTO/OFF/MANUAL Switch Status: Provides the user with the Auto/Off/Manual switch position status through the Comm ports.

A or B Regulator Type: Allows the user to select the type of regulator being used to provide a more accurate source voltage calculation.

Autodaptive® Mode Settings (Phase II)

In the Autodaptive Mode the control accomplishes transformer control, based not only on voltage regulation, but also on past watt and VAr profiles.

Bandcenter: Adjustable from 90.0 V to 135.0 V in 0.1 V increments.

Bandwidth: 1 or 2 V determined by tapchanger step size.

VRQF: Adjustable from 0.4 V to 2.0 V in 0.1 V increments.

CT to VT Phasing Correction: Adjustable from 0° to +330° in 30° increments.

VT Ratio Correction: VT correction from –12 V to +12 V in 0.01 V increments.

CT Ratio Correction: Adjustable from 50% to 200%, in 1% increments.

Voltage Reduction: Three independent steps, each adjustable from 0% to 10% in 0.1% increments of the bandcenter setpoint.

Voltage Limiting: Overvoltage and Undervoltage limits are independently adjustable, from 85 V to 135 V, in 1 V increments.

Line Drop Compensation: R & X adjustable from –24 V to +24 V in 1 V increments.

Intertap Time Delay: Adjustable from 0 seconds to 60 seconds in 1 second increments.

Raise/Lower Output Pulse Times: Adjustable from 0.2 second to 12 seconds in 0.1 second increments.

Overcurrent Tapchange Limit: This setpoint is adjustable from 1.0 PU to 3.2 PU current in increments of 0.1 PU.

Tap Position Limits (upper & lower): Adjustable from –16 to +16 in increments of 1.

VAr Bias Setpoints:

Largest Cap Bank: Adjustable from 0 KVAr to 11057 KVAr.

Transformer Impedence: Adjustable from 0% to 25%.

Line Overcurrent Tapchange Inhibit: The M-6200 blocks tapchanging above the pivot point of 1 PU current. Based on a customer setting that is variable from 200 to 640 mA.

External Inhibit of Auto Tapchange: Blocks automatic tapchanger operation in response to external command such as during fault current clearing.

User-Programmable Alarm Contact: Alerts operator to one or more of the following system conditions: Voltage Reduction (any step) invoked, Over Current Limit exceeded, Tap Block Raise in effect, Tap Block Lower in effect, Voltage Block Raise and Voltage Block Lower, Tap Time Out in Effect, Power Up, LDC in Effect and COM Block.

Presettable Operations Counter: This software counter increments by one or two counts (user-selectable) per close/open cam switch operation, and may be preset by the user from 0 to 999,999.

Resettable Operations Counter: A second software counter, similar to the operations counter, which may be reset by the user.

Monitoring/Metering

Real-Time Metering: The following measured and calculated values are available in real-time:

- Load Voltage
- Source Voltage
- Control Load kVA, or MVA
- Compensated Voltage
- Load Current
- Power Factor Load, Lead/Lag
- Primary Voltage
- Primary Current
- Primary Watts
- Primary VArs
- Primary VA
- Line Frequency
- Tap Position
- Drag Hands
- Raise/Lower Timer
- Intertap Timer
- Operation Counter
- Resettable Counter

Present Demand: The Present Demand feature captures the maximum values during the specified time interval. Time interval can be selected as 15, 30, or 60 minutes.

- Demand Load Voltage
- Primary Watts
- Primary VA
- Demand Primary Current
- Primary VArs

Demand History (Drag Hands Operation):

The following “drag-hand” values are stored with date and time stamping and are averaged over 32 seconds:

- Min Local Voltage
- Max Local Voltage

The following “drag-hand” values are stored with date and time stamping and are calculated over the demand time interval (15, 30, or 60 minutes) as selected by the user:

- Max Primary Current (Amps)
- Max Primary Watts (kW, or MW)
- Power Factor @ Max VA
- Max Primary VArs (kVAr or MVAr)
- Max Primary VA (kVA or MVA)

Energy Metering:

The following measured values are retained in non-volatile memory. A real time clock is utilized to record a date/time stamp for each quantity to indicate when the period of measurement was initiated.

- Watt Hours Forward (kWh)
- Watt Hours Reverse (kWh)
- VAr Hours Forward (kVArh)
- VAr Hours Reverse (kVArh)

Inputs

Control Voltage Input: Nominal 120 V ac, 60 Hz (50 Hz optional); operates properly from 90 V ac to 140 V ac. If set at 60 Hz, the operating system frequency is from 55 to 65 Hz; if set at 50 Hz, the operating system frequency is from 45 to 55 Hz. The burden imposed on the input is 8 VA or less. The unit should be powered from a voltage transformer connected at the controlled voltage bus. The unit will withstand twice the voltage input for one second and four times the voltage input for one cycle.

Motor Power Input: Nominal 120 V ac, at up to 6 A as required by the load, with no wiring changes required.

Motor Seal-in Input: Receives an input from the Cooper regulator motor holding switch.

Line Current Input: Line drop compensation is provided by a current transformer input with a 0.2 A full scale rating. A Beckwith Electric model M-0121 (5 A to 0.2 A) or M-0169A (5 A or 8.66 A to 0.2 A) Auxiliary Current Transformer is available when required. The burden imposed on the current source is 0.03 VA or less at 200 mA. The input will withstand 400 mA for two hours and 4 A for 1 second.

Control Power Backup Input: The standard Control Power Backup Input feature sustains operation of the control in the event of a loss of AC input power to the control. Raise and Lower commands are possible if the control's motor power remains energized. A DC power supply is required.

Counter Input: The Counter Input detects tap position changes and updates two counters, one pre-settable and one re-settable.

Binary Inputs

Voltage Reduction 1 & 2 Inputs: These inputs provide three levels of programmable voltage reduction which can be manually invoked.

Non-Sequential/ Auto Tapchanger Inhibit Input: This input provides the means to perform non-sequential operations.

Neutral Tap Position Detect Input: The Neutral Position Detect Input detects the neutral tap position, which assists the "keep track" tap position function.

Outputs

Raise Output: Capable of switching 6 A at 120 V ac to 240 V ac motor power.

Lower Output: Capable of switching 6 A at 120 V ac to 240 V ac motor power.

User-Programmable Alarm Output: One Form “C” contact capable of switching 6 A at 120 V ac or 100 mA at 120 V dc.

Front Panel Controls

Menu-driven access to all functions by way of seven pushbuttons and a two-line alphanumeric display. There are two programmable passwords available to provide various levels of access to the control functions.

The regulator control offers a 2-line by 20 character backlit LCD display for enhanced viewing in direct sunlight. It also offers a low-level LED backlight for reading in darker environments.

RAISE/LOWER switch allows local manual raise and lower commands to be initiated

AUTO/OFF/MANUAL switch allows auto operation of the control or manual operation from the panel by using the Raise/Lower toggle switch.

VOLTAGE SOURCE switch disconnects all power from the unit when selected to the **OFF** position. The **EXT** position allows the control to be powered from the front panel test jacks.

SCADA CUTOUT (LOCAL/REMOTE) switch allows the local blocking of SCADA commands.

DRAG HANDS RESET switch resets the tapchanger position indicator drag hands.

EXTERNAL POWER binding posts allow application of a 120 V RMS nominal voltage to the unit for test procedures.

METER OUT binding posts allow reading of the input voltage when used in conjunction with the **BIAS TEST VOLTAGE** screen.

SD Memory Card Slot

Allows the user to transfer Setpoint files, DNP Configuration files and Data logger files. The SD Memory Card also can be used to accomplish firmware updates.

LED Indicators

Front panel LED indicators show the following control conditions: Out-of-Band **RAISE**, Out-of-Band **LOWER**, Reverse Power Flow **REV PWR** detected, CPU **OK**., **ALARM**, Voltage Reduction **V/RED** IN EFFECT, **MANUAL, LOCAL** and **TX/RX** Transmit and Receive.

Voltage Measurement Accuracy

Control accuracy is ±0.3 % when tested in accordance with the ANSI/IEEE C57.15.9-1999 standard over a temperature range of –40° C to +85° C.

Communications

The communication ports provide access to all features, including metering, software updates, and programming of all functions. This is accomplished using a connection from any Windows™-compatible personal computer running the TapTalk® S-6200 Communications Software or SCADA communications software.

Protocols: The standard protocols included in the M-6200 are DNP3.0 and MODBUS. The USB port uses MODBUS for local communications.

Communications Via Direct Connection: TapTalk® supports direct communication (MODBUS protocol) with a Beckwith Electric Digital Regulator Control using the applicable connector (USB cable) for the PC, or Fiber Optic communication using ST standard, or two-wire RS-485.

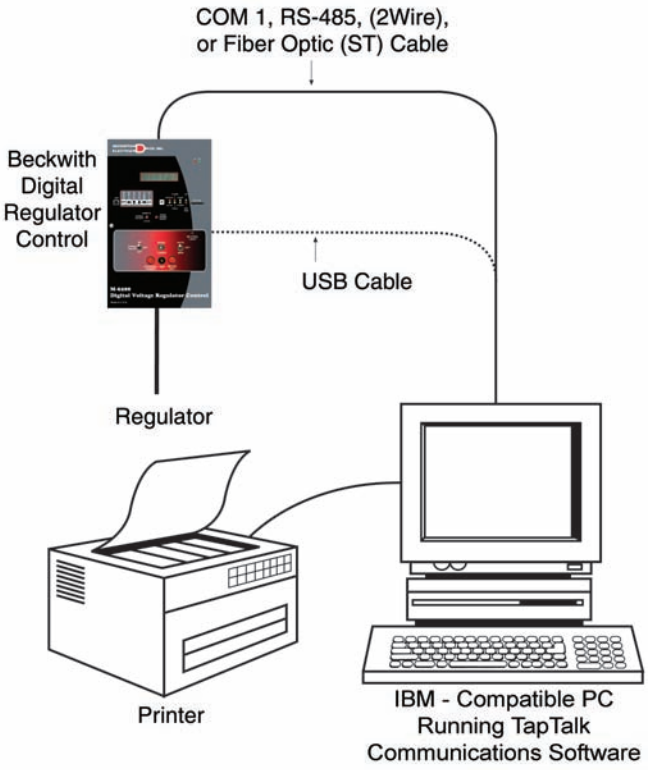


Figure 1 Direct Connection

Communications Using Networking: The addressing capability of the M-6200 allows networking of multiple Beckwith Electric Digital Regulator Controls. Each regulator control can be assigned an address ranging from 1 to 65535. Selected commands may be broadcast to all controls on the network. Figures 2, 3 and 4 illustrate typical network configurations.

Application: Using a PC, the operator has real-time, remote access to all functions of the Digital Regulator Control. The control can act as the monitoring point for all voltage, current, and related power quantities, thereby simplifying operation while avoiding transducers and multiple Remote Terminal Unit (RTU) analog inputs. The protocols implement half-duplex, two-way communications. This allows all functions, which would otherwise require the presence of an operator at the control, to be performed remotely. Communication capabilities include:

- Interrogation and modification of setpoints
- Broadcast of commands, such as tap change inhibit and voltage reduction (up to three steps) to networked controls
- Recognition of alarm conditions, such as voltage extremes and excessive load
- Selective control of raise and lower tap change operations
- Re-configuration of the control, such as a change to the demand integration time period or a selection of different alarm parameters

Unit Identifier: A 2-row by 20-character alphanumeric sequence, set by the user, can be used for unit identification.

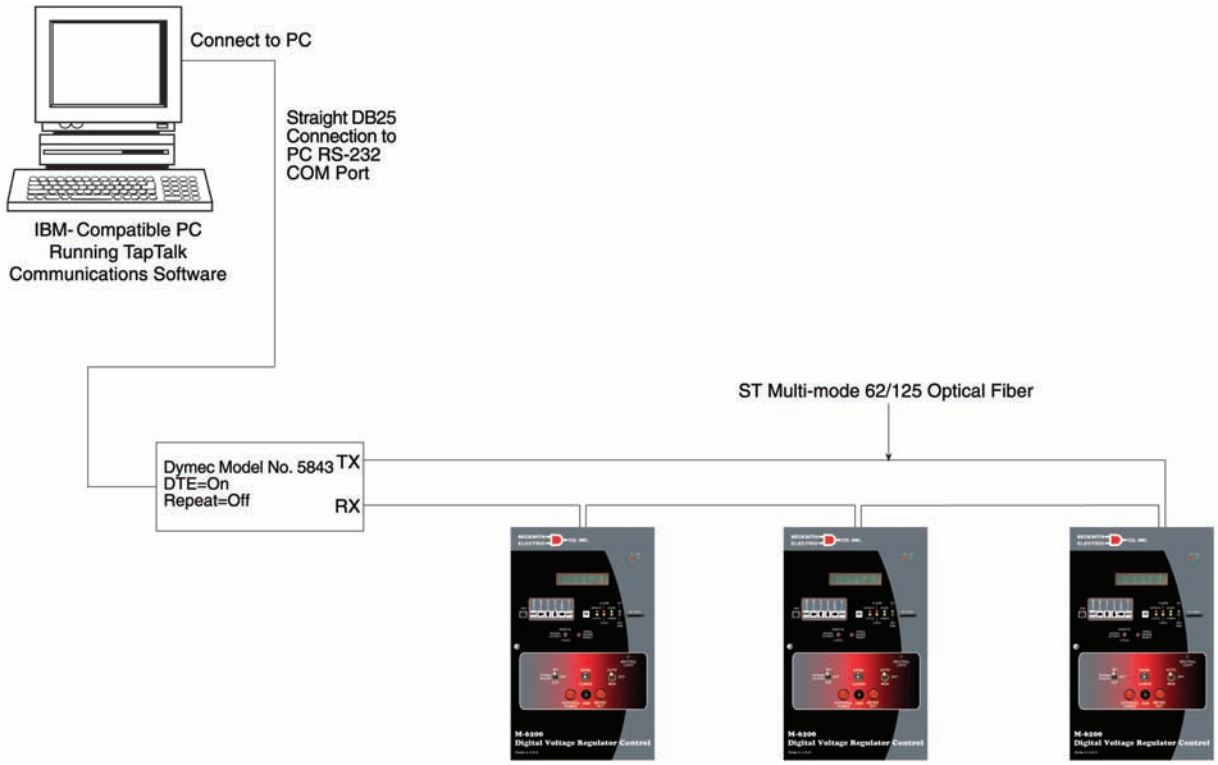


Figure 2 Fiber Optic Connection Loop

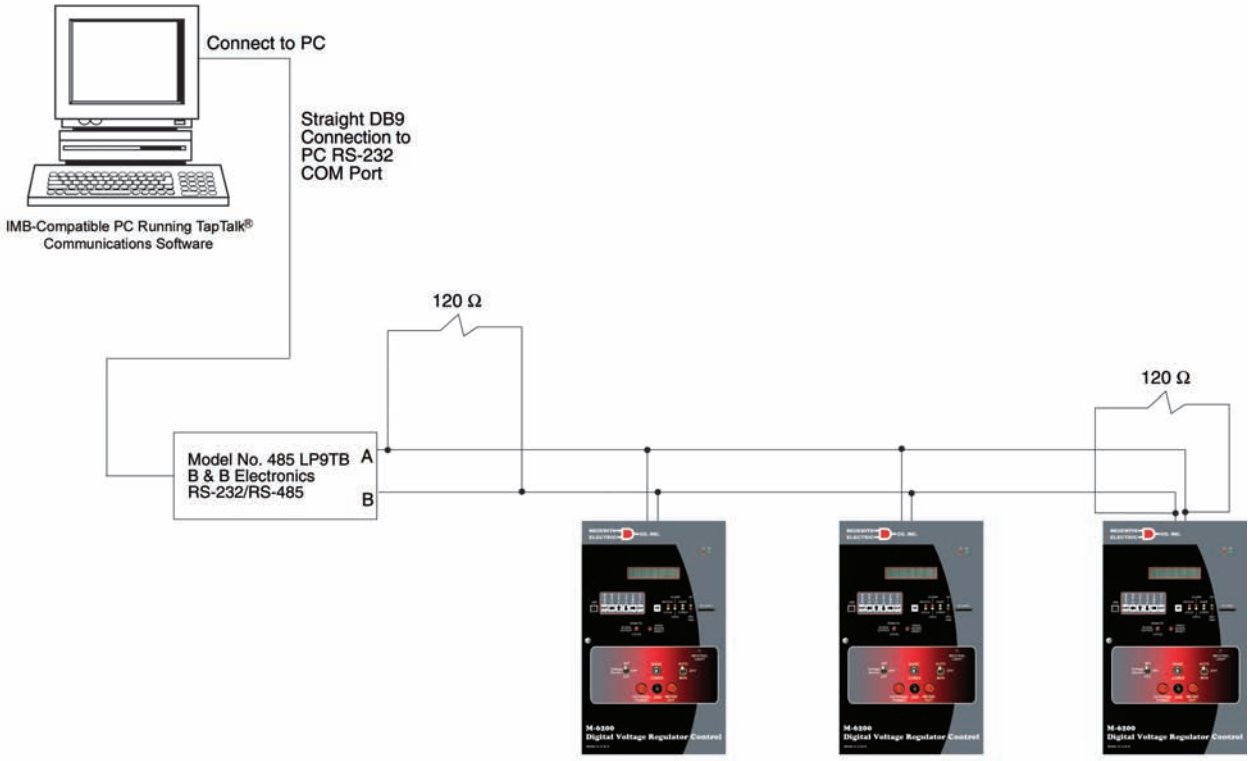


Figure 3 RS-485 Network Connection

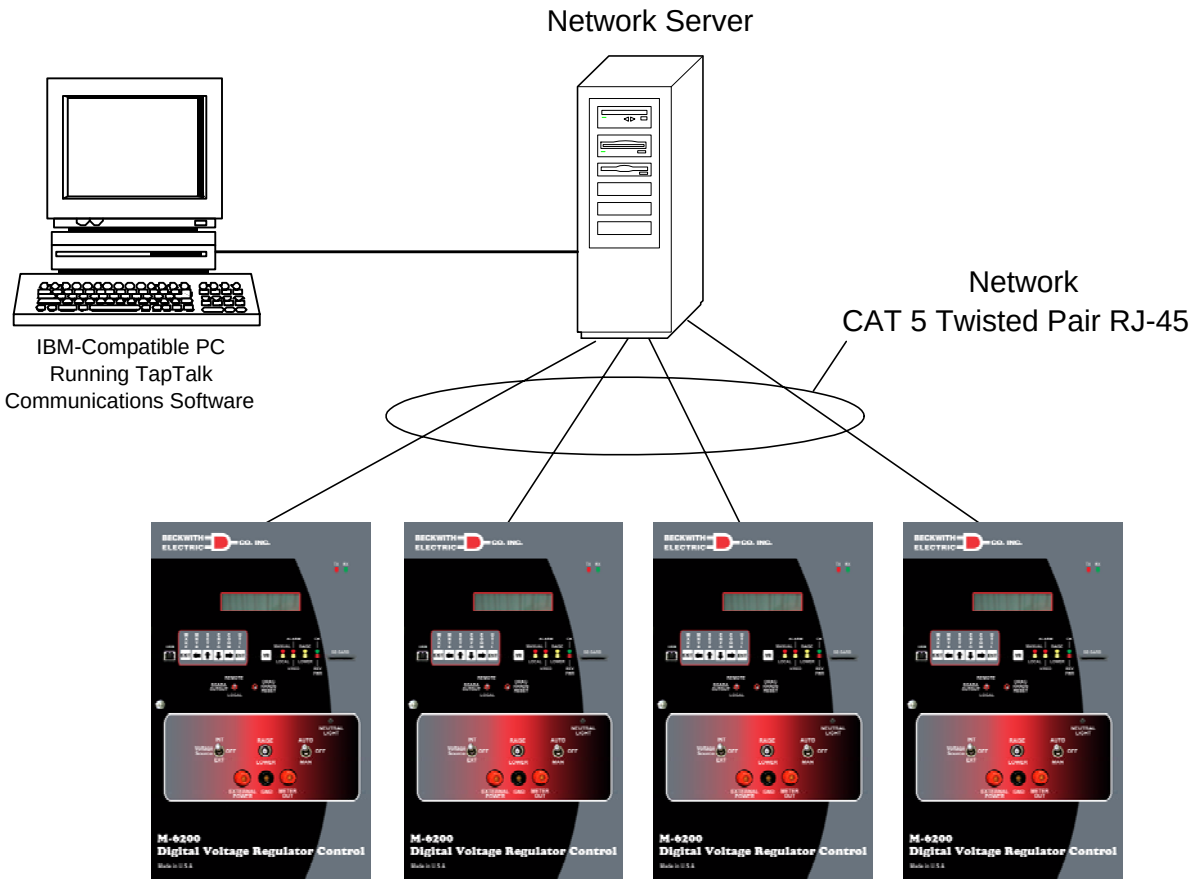


Figure 4 Ethernet Network Connection (Phase II)

Environmental

Temperature: Control operates from –40° C to + 85° C.

■ **NOTE**: The LCD display's functional temperature range is –20° C to +70° C.

IEC 60068-2-1 Cold, –40° C
IEC 60068-2-2 Dry Heat, +85° C
IEC 60068-2-78 Damp Heat, +40° C @ 95% RH

Transient Protection

High Voltage

All input and output terminals will withstand 1500 V ac rms to chassis or instrument ground for one minute with a leakage current not to exceed 25 mA, for all terminals to ground. Input and output circuits are electrically isolated from each other, from other circuits and from ground.

Surge Withstand Capability

IEEE C37.90.1-2002	2,500 Vpk Oscillatory 4,000 Vpk Fast Transient Burst
IEEE C37.90.1-1989	2,500 Vpk Oscilliatory 5,000 Vpk Fast Transient

■ **NOTE**: Disturbance is applied to digital data circuits (RS-485) ports through capacitive coupling clamp.

Radiated Electromagnetic Withstand Capability

All units are protected against electromagnetic radiated interference from portable communications transceivers.

Fast Transient Disturbance Test

EN61000-4-4-2007

Class A (4 Kv, 2.5 kHz)

■ **NOTE**: Disturbance is applied to digital data circuits (USB, RS-485) ports through capacitive coupling clamp.

Physical

Size: 9.25" wide x 15.00" high x 3.25" deep (23.5 cm x 38.1 cm x 8.26 cm)

Mounting: Unit mounts directly into General Electric, Siemens, Howard Industries and Cooper Regulator control cabinets with appropriate installation kits.

Approximate Weight: 6 lbs, 5 oz (2.95 kg)

Approximate Shipping Weight: 10 lbs, 5 oz (4.56 kg)

M-2026/M-2027 Control Power Backup Supplies

M-2026 AC-DC Control Power Backup Supply

The M-2026 Control Power Backup Supply will accept either an AC or DC (105 to 140 V) input, and output a regulated +12 V dc (±0.5 V) output voltage. The unit incorporates a fused input, surge protection, and reverse polarity protection. The M-2026 is capable of up to a 1.5 Ampere output.

M-2027 Control Power Backup Supply-AC Only

The M-2027 will accept an AC (105 to 140 VAC, 50/60 Hz) input and output +12 V dc (Nominal). The M-2027 is capable of loads up to 1.0 Ampere. The unit incorporates a fused input and surge protection.

The M-2026 and M-2027 units are housed in a non-weathertight enclosure and equipped with screw terminal blocks for input and output connections.

Use of a control power backup supply other than the M-2026 and M-2027 will compromise system reliability if the power supplies chosen do not conform to the specifications listed above.

Patent & Warranty

The Regulator Controls are covered by U.S. Patents 5,315,527 and 5,581,173.

The Regulator Controls, M-2026 AC-DC Control Power Backup Supply and M-2027 Control Power Backup Supply-AC Only are covered by a ten-year warranty from date of shipment.

Specification subject to change without notice.

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