Digital Regulator Control M-6200
Digital Regulator Control for General Electric, Siemens, Cooper and Howard Regulators

M-6200
Digital Voltage Regulator Control
Made in U.S.A.
Features

- 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
- 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
- Motor Power Input
- Load 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
- Motor Current Profiling
- VAr Bias
- Smart Flash SD Card Slot
- Sequence of Events (SOE)
- Data Logging
- Oscillography
- 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
- HMI Menu’s available in English or Spanish
- User configurable Wakeup screen with SD Card saving feature

Optional Features

- SCAMP™ (SCADA Controllable Auto/Manual Pushbutton)
- Ethernet Port is available through a RJ-45 jack (10/100 Base-T) or Fiber Optic through ST or SC connectors (100 Base-Fx). These ports support DNP over TCP/IP and MODBUS over TCP/IP.
- RS-232 Communications Port
- Local Wireless Bluetooth capability

Accessories

- M-2026 AC-DC Control Power Backup Supply
- M-2027 Control Power Backup Supply—AC Only
- B-0920 Control Power Backup Harness
**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.

**Load Overcurrent Tapchange Inhibit**: Adjustable from 200 mA to 640 mA of load 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, Load Current Limit Exceeded, Tap Block Raise in Effect, Tap Block Lower in Effect, Selftest (Deadman) and LDC/LDZ.

**Tap Position Knowledge**
In most applications, tap position information can be maintained by means of 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.

**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.
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Monitoring/Metering

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

- Average Load Voltage
- Average Source Voltage
- Control Load kVA, or MVA
- Average Compensated Voltage
- Average Load Current
- Power Factor Load, Lead/Lag
- Primary Voltage
- Primary Current
- Primary Watts
- Primary VAr
- Primary VA
- Frequency
- Tap Position
- Drag Hands
- Raise/Lower Timer
- Intertap Timer
- Operation Control
- 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 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 VAr (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)

Oscillograph:

The Oscillograph Recorder provides comprehensive data recording (voltage, current, and status input/output signals) for all monitored waveforms (at 16, 32 or 64 samples per cycle). Oscillograph data can be downloaded using the communications ports to any IBM compatible personal computer running the TapTalk® S-6200 Communications Software. Once downloaded, the waveform data can be examined and printed using M-2829 TapPlot™ Analysis Software. The waveform data is also available in COMTRADE file format.

Sequence of Events:

The Sequence of Events Recorder provides comprehensive time tagged data recording of control parameters that include Voltage, Frequency, Tap Position, Current, Counters and Harmonics. The total number of events that can be recorded is 129. The Sequence of Events Recorder is triggered by user selectable programmable parameter logic or manually by the user.

Data Logging:

The Data Logging feature allows the user to record data internally into nonvolatile memory. The Data Log is saved in Comtrade format. The Data Log can be downloaded utilizing either MODBUS or DNP protocols.
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 or 240 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.

Load 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 125 VAC or 0.2 A at 125 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.

The Front Panel is available in either English or Spanish. The HMI screen display is also available in English or Spanish.

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 processing 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 switch resets the tapchanger position indicator drag hands.

METER OUT binding posts allow reading of the input voltage when used in conjunction with the BIASED TEST VOLTAGE screen.
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**Smart Flash SD Card Slot**
Allows the user to perform the following functions:
- Load Setpoints
- Save Setpoints
- Save Oscillograph Records
- Clone Save
- Save DNP Config
- Clone Load
- Firmware Update
- Save Data Log
- Save Sequence of Events
- Load DNP Config

**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.

**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. The optional Ethernet Port supports DNP3.0 and MODBUS protocols simultaneously.

**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](image_url)
**Optional Ethernet Port:** The optional Ethernet Port provides a RJ45 (10/100 Base-T) or a Fiber Optic through ST or SC connectors (100 Base-Fx) interface for ethernet communication to the M-6200. The protocols supported are: MODBUS over TCP, DNP3.0 over TCP and DNP3.0 over UDP. The port supports up to eight concurrent connections. The maximum number of allowed DNP connections is five. The maximum number of MODBUS connections is eight. The port supports DHCP protocol and also allows manual configuration of the Ethernet port. MODBUS protocol “Port Number” and DNP Protocol “Port Number” are required for manual configuration.

**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 a device address, Feeder Address or Substation Address ranging from 1 to 65519. Selected commands may be broadcast to all controls on the network. Figures 2, 3 and 4 illustrate typical network configurations. Addresses 1 to 247 can be assigned to MODBUS and 1 to 65519 for DNP3.0.

**Optional Bluetooth:** The optional Bluetooth provides wireless access to the M-6200. With Bluetooth the user is able to configure the control, read status and metering values as well as change setpoints.

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**Figure 2  Fiber Optic Connection Loop**

**Figure 3  RS-485 Network Connection**
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Network
CAT 5 Twisted Pair RJ-45
or
Fiber Optic Through
ST or SC Connectors

IBM-Compatible PC
Running TapTalk Communications Software

Network Server

HUB

Figure 4  Optional Ethernet Network Connection

Cellular Modem with TCP/IP or
UDP capabilities using
standards-based EDGE, GPRS or CDMA
technologies

RS232 Link

Figure 5  Cellular Modem Network
**Application:** Using a PC or wireless modem, 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
- Unsolicited exception reporting multicast capability using UDP

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

**Environmental**

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

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

IEC 60068-2-1 Cold, –40° C
IEC 60068-2-2 Dry Heat, +80° C
IEC 60068-2-78 Damp Heat, +40° C @ 95% RH
IEC 60068-2-30 Damp Heat Condensing cycle 25° C, +55° 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 V pk Oscillatory
4,000 V pk Fast Transient Burst

IEEE C37.90.1-1989 2,500 V pk Oscillatory
5,000 V pk Fast Transient

■ **NOTE:** Disturbance is applied to digital data circuit (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**

IEC 60255-22-4-2008

Class A (4 Kv, 5 kHz)

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

**Dielectric Withstand**
IEC 60255-5 1,500 V ac for 1 minute applied to each independent circuit to earth
1,500 V ac for 1 minute applied between each independent circuit

**Impulse Voltage**
IEC 60255-5 5,000 V pk, +/- polarity applied to each independent circuit to earth
5,000 V pk, +/- polarity applied between each independent circuit
1.2 by 50 µs, 500 ohms impedance, three surges at 1 every 5 seconds

**Insulation Resistance**
IEC 60255-5 > 100 Megaohms

**Surge Immunity**
IEC 60255-22-5 2,000 V pk, +/- polarity applied, 1.2 µs by 50 µs, five surges, 1 every 5 seconds

**Compliance**
UL 61010-1:2008, 2nd Ed., CAT III, Pollution Degree 2
CSA C22.2 No. 61010-1:2008, 2nd Ed., CAT III, Pollution Degree 2

**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)

**Recommended Storage Parameters**
*Temperature:* 5°C to 40°C.
*Humidity:* Maximum relative humidity 80% for temperatures up to 31°C, decreasing to 31°C linearly to 50% relative humidity at 40°C.
*Environment:* Storage area to be free of dust, corrosive gasses, flammable materials, dew, percolating water, rain and solar radiation.
**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.*