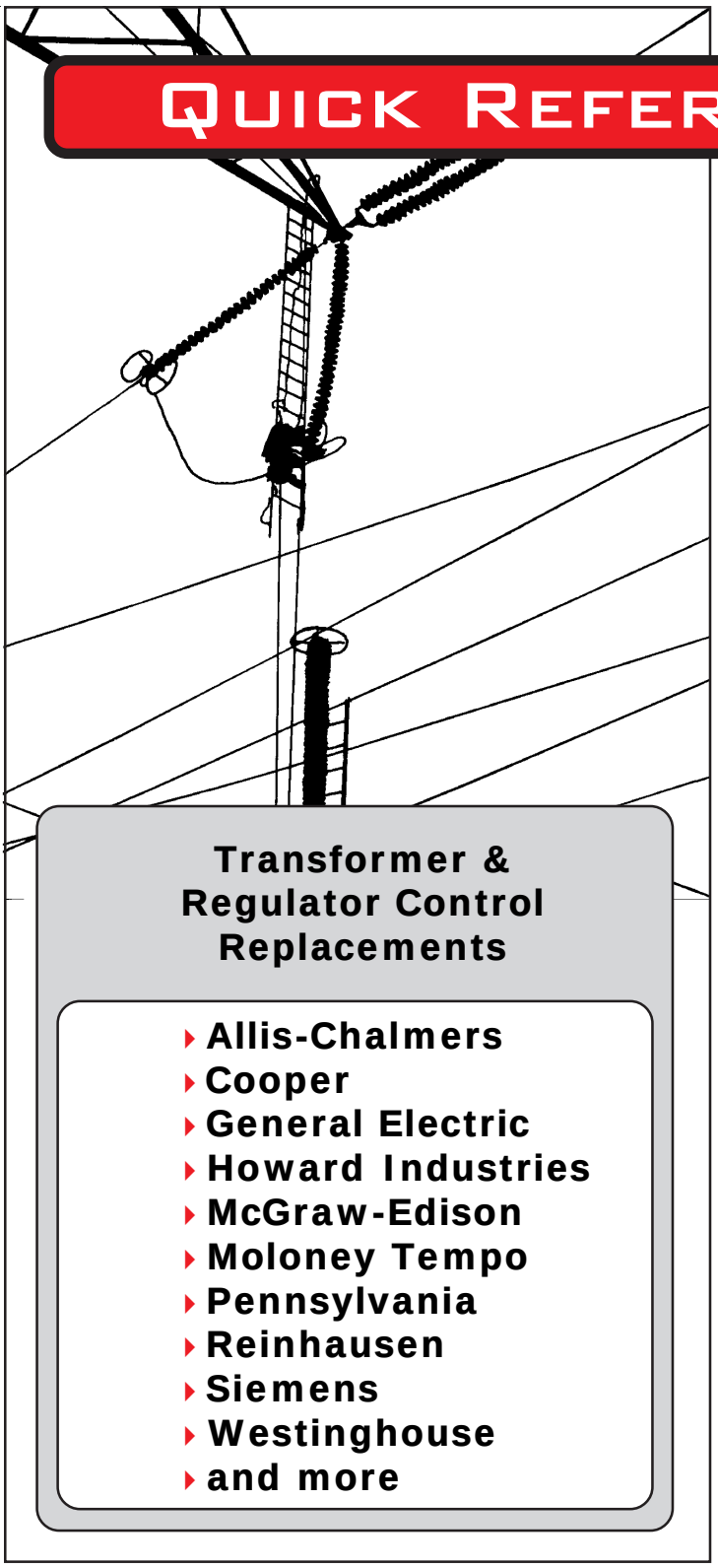
BECKWITH ELECTRIC CO. INC.

Quick Reference Guide



Transformer & Regulator Control Replacements

- Allis-Chalmers
- Cooper
- General Electric
- Howard Industries
- McGraw-Edison
- Moloney Tempo
- Pennsylvania
- Reinhausen
- Siemens
- Westinghouse
- and more

REPLACEMENT PROGAM

6190-118th Avenue North • Largo, Florida 33773-3724 U.S.A. • 727-544-2326
E-mail: marketing@beckwithelectric.com • Online: www.beckwithelectric.com

Beckwith Electric Transformer & Regulator Controls
Quick Reference Guide

Original Control		Beckwith Replacement
Transformer Controls		
General Replacement		
	Beckwith Electric M-0270 and for General Purpose Panel-Mount Applications	**M-2270B**
Allis-Chalmers, Siemens-Allis, Siemens		
	UJ-3T, SJ-4T, SJ-5T, SJ-6T, IJ-2T, IJ-2AT, MJ-3T, MJ-3AT	**M-2339**
	Surface Mount Models with Suffix "T" when Auxiliary CT Replacement Not Needed	**M-2278**
AVE, GEC		
	Ave 3, Ave 4, GEC VTJC	**M-2131**
General Electric		
	Static LTC Control, Some Balance-Beam Models ("Bubble Gum Machine")	**M-2280B**
Howard Industries/I.C.M.I.		
	USC-1	**M-2301A**
Moloney Tempo		
	LTC Control Panel	**M-2174B**
Pennsylvania McGraw-Edison		
	Tapchanger Mechanism From 1963-1978 Types: 550, 550A, 550B, 550C, 396B, 494B, 496B, 995, 996	**M-2279B**
	Tapchanger Mechanism Before 1963 Types: 110, 220, 220A, 550, 550B	**M-2379**
	Tapchanger Mechanism After 1978 Types: 550 BHS LTC	**M-2354C**
Reinhausen		
	MK20	**M-2220**
	MK30	**M-2230**
Westinghouse		
	SVC, SVR	**M-2067**
	MS-TM Panel	**M-2286**
	SJS	**M-2326**
	Control for URS Tapchanger	**M-2357**
Regulator Controls		
General Replacement		
	General Purpose Panel-Mount Applications	**M-2270B**
Allis-Chalmers, Siemens-Allis, Siemens		
	Some UA series, UJ-2, UJ-4, UJ-5, UJ-5C, SJ-4, SJ-5, SJ-6, IJ-2, IJ-2A MJ-1A, MJ-2A, MJ-3, MJ-3A, MJ-X	**M-2271B**
	Type UJ-1	**M-2347**
Cooper (McGraw-Edison/Cooper)		
	CL-2, CL-2A, CL-4A, CL-4B, CL-4C, CL-5A, CL-5C, CL-5D, CL-5E, CL-6	**M-2355B**
General Electric		
	ML-32, VR-1, SM1, SM2, SM-2A, SM-3 (Solid-State Type)	**M-2293B**
	ML-32 (Balance-Beam Type)	**M-2264B**
	ML-32 (Balance-Beam Type - "Bubble Gum Machine")	**M-2356B**
Howard Industries/I.C.M.I.		
	UVR-1	**M-2301A**
Pennsylvania McGraw-Edison		
	Pole Star Hinge Pins on left of cabinet	**M-2345A**
	Pole Star Hinge Pins on right of cabinet	**M-2324B**
	Tapchanger Mechanism from 1963-1978 Types: 550, 550A, 550B, 550C, 396B, 494B, 496B, 995, 996	**M-2279B**
Westinghouse		
	SJS	**M-2326**
	SVC, SVR	**M-2067**
	URL	**M-2323**

Replacement Program

Beckwith Electric provides three levels of replacement control assistance:

LEVEL 1

Direct Replacements
The Beckwith Electric replacement controls described in this Quick Reference Guide are designed to be direct replacements for existing controls. We can provide pricing information immediately and most controls are available from stock.

Refer to the Quick Reference Guide to find a Beckwith Electric direct replacement control. The guide is organized into two sections: transformer controls and regulator controls. Controls are listed alphabetically by original manufacturer within each section.

LEVEL 2

Engineered Products
Engineered Products are available to suit specific application needs. Some are complete replacement panels that fit in existing transformer/regulator control compartments and upgrade old controls to include such additional features as circulating current paralleling, SCADA interfaces and delta-VAr control. In addition, there are controls mounted in an enclosure for use when a complete control package is an economical alternative.

Engineered Products are available on short lead times. Contact Beckwith Electric for assistance in identifying an Engineered Product to suit your needs. A complete listing of Engineered Products and specifications-for each product is available upon request.

LEVEL 3

First-Time Applications & Design of New Controls
In cases where Beckwith Electric does not manufacture a direct replacement or an Engineered Product for your specific application, we will review your replacement requirements and either suggest a control from our product line for retrofit and evaluation by you, or offer a proposal for the design of a new control. If you receive a control for evaluation, you would fit the Beckwith Electric control in your existing cabinet, performing the mechanical and wiring conversion. However, if you determine after initial inspection that the suggested control is not suited to this specific application, you may return it (undamaged) and there will be no charge, except for shipping costs. You may then decide to have Beckwith provide a proposal for the design of a new control.

In order for us to determine your replacement control requirements, you will typically need to provide the following information:

- Dimensions of old control and cabinet
- Photo of old control and cabinet
- Schematic and wiring diagram of old control
- Instructions for old control
- Special application information concerning original control, such as paralleling

The proposal for the design of a new control will include a brief description of the control, price, delivery schedule and preliminary electrical and mechanical sketches. Upon acceptance of the proposal, Beckwith Electric will design and build the new replacement control and also supply necessary instructions for installation and operation. The design effort will usually be accomplished in-house at Beckwith Electric, although sometimes an on-site visit is necessary.

Beckwith Electric can provide assistance in assessing your system needs on a station-by-station basis and developing a replacement program for you. An upgrade replacement program may involve the use of paralleling, addition of communication capabilities, updating of system control diagrams or other needs as defined.

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Quick Reference Guide

The Quick Reference Guide on the following pages provides an easy method for finding the Beckwith Electric direct replacement control you need. Located on the left side of the guide is the photo of the existing control, manufacturer's name and control type. Use the description to match the existing control to the corresponding Beckwith Electric digital replacement. Options, selected by the customer at the time of purchase, are listed along with photos of new Beckwith Electric digital controls.

All of the controls listed in the Quick Reference Guide are Level 1 replacements— direct replacements designed to be put into service quickly and easily, using mounting features and wiring harnesses that match existing connections.

■ **NOTE:** *Due to variations in a manufacturer's control or custom changes performed on a control, the user may need to adapt the Beckwith Electric replacement control to match an installation. Correct installation using Beckwith Electric equipment is the responsibility of the user.*

The Beckwith Electric direct replacement controls offer different features and options. The tables provide additional information on the models and their corresponding features.

ANALOG CONTROL

The M-0067E is a solid-state voltage regulating relay that uses average voltage measurement techniques and is known in the industry for its history of reliable performance. It can be used instead of the M-2067 and M-2001.

- Average voltage measurement techniques
- Voltage and bandwith dials operate with ANSI/IEEE 1% accuracy requirement from -40 to +80 Degrees C.
- Standard features of the M-0067E include:
  - Accurate R and X line drop compensator
  - Band-edge LED indicators
  - In-place testing capability
  - Provision for circulating paralleling using the M-0115 Parallel Balancing Module

M-0067E

M-2001 Control Features

Beckwith Electric's M-2001 Tapchanger Control line introduces a unique concept in replacements by using a single tapchanger control—the M-2001—with interchangeable adapter panels. These panels are sized to correspond to the original manufacturer's controls and use the same mountings and wiring harnesses that match the existing connections, for easy replacements.

The M-2001 Tapchanger Control is micro-controller-based using digital signal processing technology and waveform sampling to accurately and reliably measure system parameters. The M-2001 mounts easily to any of the adapter panels using four screws and a quick disconnect plug.

The result is a universally-applied control attached to identically-designed replacement panels.

M-2001C

Adapter Panel	Features of Adapter Panels	Features of M-2001 Tapchanger Control
M-2067 M-2174B* M-2286* M-2339* M-2357*	Replacement panels indicated by an * include the M-2067 Adapter Panel and must be used with the M-2001 Digital Tapchanger Control (see description for standard features included with the M-2001). Standard features of the M-2067A include: • voltage-sensing fuse that can be changed from the front panel • provision for circulating current paralleling using the M-0115A Parallel Balancing Module	True rms voltage measurement techniques meet ANSI/IEEE ± 0.7% accuracy requirement from -40 to +80C responding to the fundamental frequency component of voltage only. Standard features of the M-2001 Tapchanger Control include: • definite or inverse time characteristic • ±R / ±X line drop compensator • LDC-Z line drop compensation • band-edge LED indicators • in-service testing using the bias voltage feature • three-step voltage reduction • reverse power detection and automatic regulation • display of system parameters • demand metering • circulating current paralleling method • ΔVAr™ paralleling methods (optional) • self-test alarm and user-programmable alarm • RS-232, RS-485, and fiber optic serial communication ports • date/time stamping of maximum/minimum conditions • line overcurrent tapchange inhibit • voltage limiting and automatic runback • remote inhibit of auto operation • sequential, non-sequential or pulsed operation • tap position knowledge • long-term data logging • several on-board protocols • KWHr and KVArHr metering • TapTalk® Communications Software including harmonic analysis and Palm OS® software • tap and voltage limits • frequency of tap position operation record
M-2131 M-2264B M-2270B M-2271B M-2278 M-2279B M-2280B M-2293B M-2323 M-2324B M-2326 M-2345A M-2347 M-2354C M-2355B M-2356B M-2379	Adapter panels must be used with the M-2001 Tapchanger Control (see description for standard features included with the M-2001). Standard features include: • Auto/Off/Manual switch • Raise/Off/Lower switch • Voltage Source switch • front-panel fuses for motor power, test terminal and voltage testing • in-place testing capabilities with front-panel binding posts • drag hands reset pushbbutton • neutral light Provision for the inclusion of the M-0329 LTC Backup Control is available as an option on the M-2279B and M-2379 only.	

Transformer Controls

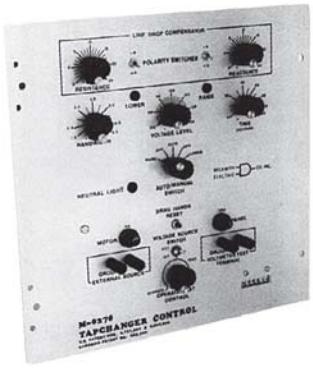
Allis-Chalmers
Siemens-Allis
Siemens
UJ-3T, SJ-4T, SJ-5T,
SJ-6T, IJ-2T, IJ-2AT,
MJ-3T, MJ-3AT

M-2339
and M-2001
Tapchanger Control

Allis-Chalmers
Siemens-Allis
Surface Mount Models
With Suffix “T”
When Auxiliary CT
Replacement Not Needed

M-2278
and M-2001
Tapchanger Control

Beckwith Electric
M-0270 and for
General Purpose
Panel-Mount
Applications

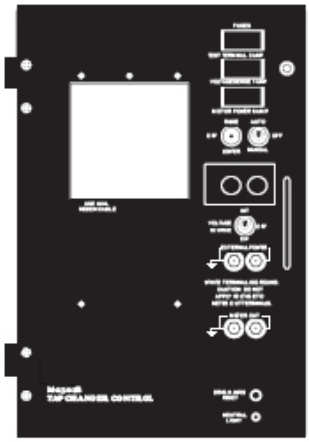


M-2270B
and M-2001
Tapchanger Control

General Electric
Static LTC Control, Some Balance-Beam Models ("Bubble Gum Machine")

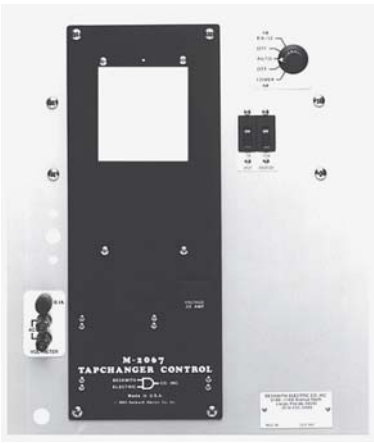
M-2280B
and M-2001
Tapchanger Control

Howard Industries
I.C.M.I.



M-2301A
and M-2001
Tapchanger Control

Moloney Tempo
LTC Control Panel



M-2174B
and M-2001
Tapchanger Control

Pennsylvania
McGraw-Edison
Tapchanger
Mechanism
From 1963-1978
Types: 550, 550A,
550B, 550C, 396B,
494B, 496B, 995, 996

M-2279B
and M-2001
Tapchanger Control
Inclusion of
M-0329 LTC Backup
Control Protection
available as an option

Pennsylvania
McGraw-Edison
Tapchanger Mechanism
Before 1963
Types: 110, 220,
220A , 550, 550B

M-2379
and M-2001
Tapchanger Control
Inclusion of
M-0329 LTC Backup
Control Protection
available as an option

Pennsylvania
McGraw-Edison
Tapchanger Mechanism
After 1978

M-2354C
and M-2001
Tapchanger Control

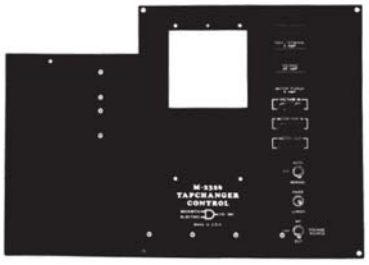
Westinghouse
SVC, SVR

M-2067
and M-2001
Tapchanger Control

Westinghouse
MS-TM Panel

M-2286
and M-2001
Tapchanger Control

Westinghouse
SJS



M-2326
and M-2001
Tapchanger Control

Regulator Controls

Allis-Chalmers
Siemens-Allis
Some UA Series
UJ-2, UJ-4,
UJ-5, UJ-5C,
SJ-4, SJ-5, SJ-6,
IJ-2, IJ-2A, MJ-1A,
MJ-2A, MJ-3, MJ-3A,
MJ-X

M-2271B
and M-2001
Tapchanger Control

Allis-Chalmers
Type UJ-1

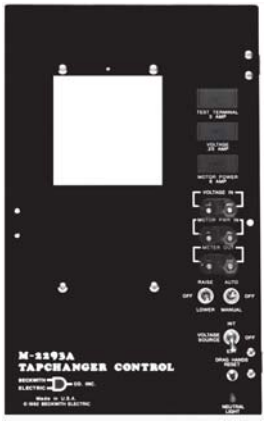
M-2347
and M-2001
Tapchanger Control

Cooper
McGraw-Edison/Cooper
CL-2, CL-2A, CL-4A,
CL-4B, CL-4C, CL-5A,
CL-5C, CL-5D, CL-5E,
CL-6

M-2355B
and M-2001
Tapchanger Control

General Electric
ML-32, VR-1, SM1,
SM2, SM-2A, SM-3*,
(Solid State Type)

*Requires Optional SM-3 Harness



M-2293B
and M-2001
Tapchanger Control

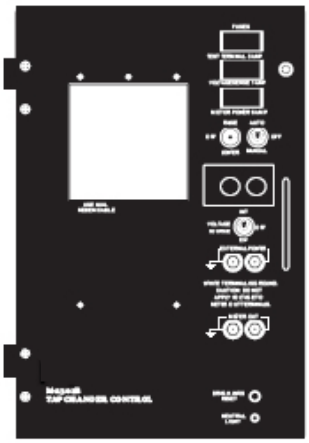
General Electric
ML-32
(Balance-Beam Type)

M-2264B
and M-2001
Tapchanger Control

General Electric
ML-32
(Balance-Beam-Type
–"Bubble Gum
Machine")

M-2356B
and M-2001
Tapchanger Control

Howard Industries
I.C.M.I.
UVR-1



M-2301A
and M-2001
Tapchanger Control

Pennsylvania
McGraw-Edison
Pole Star
Hinge Pins
on Left of Cabinet

M-2345A
and M-2001
Tapchanger Control

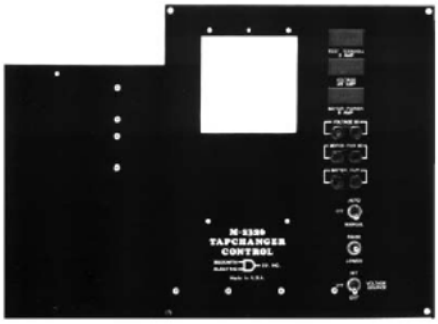
Pennsylvania
McGraw-Edison
Pole Star
Hinge Pins
on Right of Cabinet

M-2324B
and M-2001
Tapchanger Control

Pennsylvania
McGraw-Edison
Tapchanger
Mechanism From
1963-1978
Types: 550, 550A,
550B, 550C, 396B,
494B, 496B, 995, 996

M-2279B
and M-2001
Tapchanger Control
Inclusion of M-0329
LTC Backup
Control Protection
available as option

Westinghouse
SJS

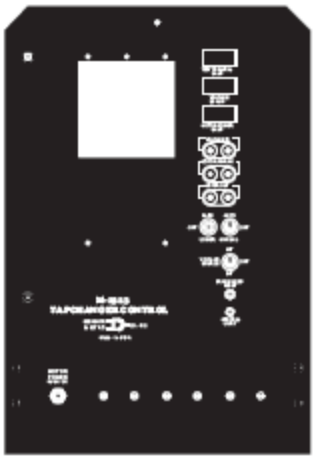


M-2326
and M-2001
Tapchanger
Control

Westinghouse
SVC, SVR

M-2067
and M-2001
Tapchanger Control

Westinghouse
URL



M-2323
and M-2001
Tapchanger Control

Auxiliary Products

Auxiliary Products

M-0121/M-0169A
Auxiliary Current Transformers

M-0121 is a 5 A to 0.2 A for use with Beckwith Electric tapchanger controls when there is no additional burden present.

M-0169A is 5 A or 8.66 A to 0.2 A for use in higher burden current circuits, such as are found in paralleling schemes.

Output is protected against overvoltage.

M-0127A/M-0170A
Lower Burden
Sensitive AC
Current Relays

M-0127A guards against damaging excessive circulating current when used on the circulating current circuit of paralleled LTC transformers.

M-0170A avoids excessive wear to the switching mechanism of LTC transformers under high load conditions.

Can be used in other current- and voltage-sensing applications.

M-0127's adjustment range is 0.01 to 0.1 A; M-0170's is 0.2 to 0.4 A.

M-0115A
Paralleling Balancing Module

Provides all the components needed to parallel an LTC transformer using the circulating current method or ΔVAR™-1 method. A circulating current sensitivity dial avoids the problems of hunting or permitting the transformers to be too many steps apart.

M-0329B
LTC Backup Control

Prevents a defective LTC tapchanger control from running the voltage outside the upper and lower limits.

Prevents the line drop compensator from raising the voltage too high under full or overload conditions.

Selectable bandcenter and fixed deadband ranges allow the M-0329 to match any LTC transformer control.

Responds to a voltage excursion within 0.2 seconds.

Operates within ±1% voltage accuracy.

M-5329
LTC Backup Control

Prevents a defective LTC tapchanger control from running the voltage outside the upper or lower limits.

Prevents the line drop compensator from raising the voltage too high under full or overload conditions.

Monitors all three phases and blocks LTC tapchanger operation if any phase is outside the setpoints.

Fully transient protected and operates within ±1% voltage accuracy over a temperature range of -40° to +80° C

M-2053
Adapter Panel for Surface Mounting Applications

Connects easily to the M-2001 Series Digital Tapchanger Control using four mounting screws and 24-pin connector

Provides mounting adaptable to several different configurations

Provides built-in CT shorting protection when the M-2001 Series Digital Tapchanger Control is removed

Auxiliary Products

M-2025C
Current Loop Interface Module

Connects easily to the M-2001C Digital Tapchanger Control using a 6-pin connector

Provides a 9-position terminal block for easy connections

Enclosed components permit user to select one of four current range configurations

Small size permits mounting on any flat surface at least 4" wide and 2–5/8" high

Will accept a direct input from an optional tap position sensor (M-2948 or M-2949)

M-2948 & M-2949
Tap Position Sensors

Directly interfaces with the M-2025C Current Loop Interface which provides the tap position to the M-2001C Tapchanger Control

M-2948 — measures a 0° to 288° rotation, for use with a Qualitrol Position Indicator, Model 081-002-01 or equivalent

M-2949 — measures a 0° to 320° rotation, for use with a Qualitrol Position Indicator, Model 082-020-01, 082-001-01, or equivalent

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M-2026 & M-2027
AC to DC Backup Power Supply

Maintains the M-2001C energized during power outages to maintain the continuity of the communications loop

Accepts power input from station auxilary supply over a range of 105 V ac to 140 V ac (50 or 60 Hz) or 105 V dc to 140 V dc

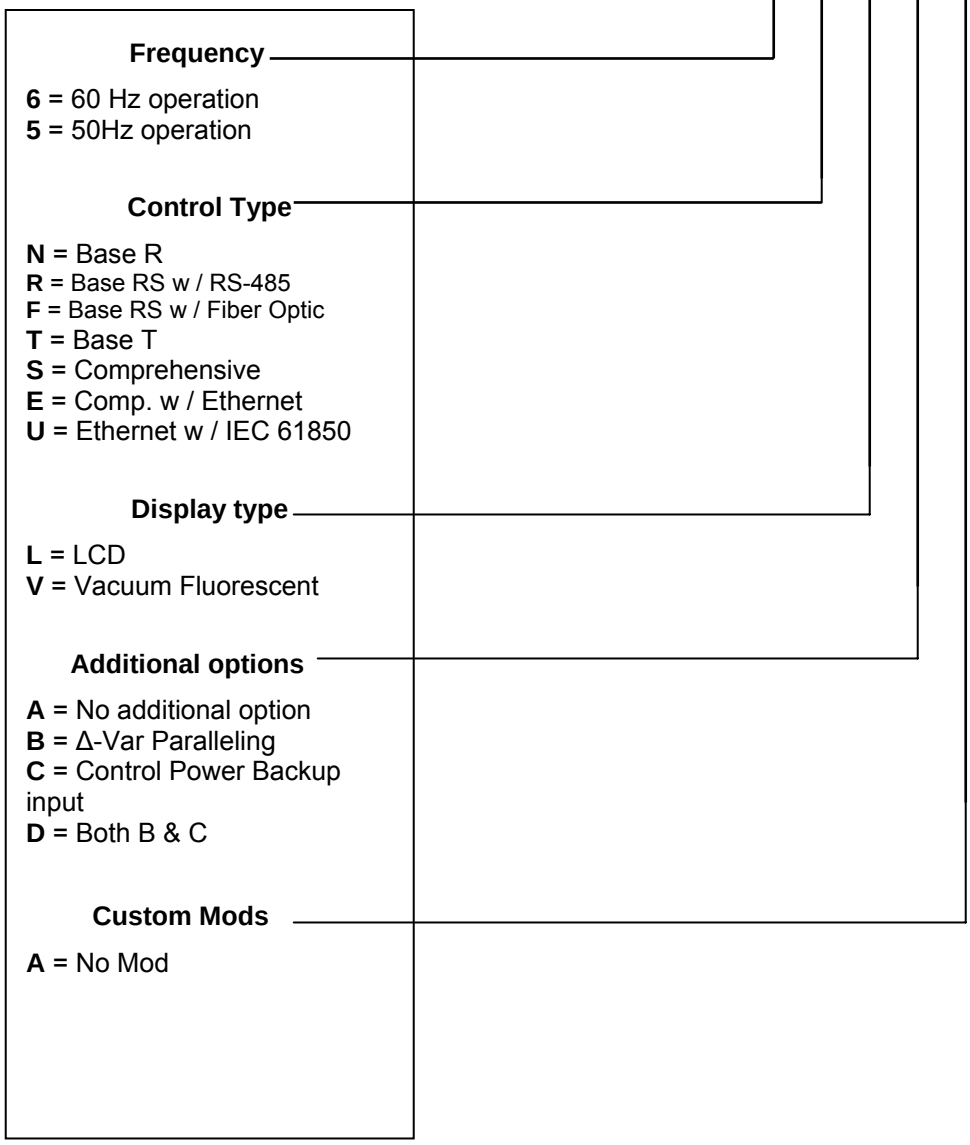
Fuse protected and transient suppressed, input and output

Substation hardened -40° C to +85° C

Conformal coated

M-2001C Style Selection Chart

M-2001C- 6 N L A A



Option Availability:	VFD	D-VAR	Ethernet	DC pwr
M-2001C - Comp	Yes	Yes	Yes	Yes
M-2001C - Base-T	Yes	Yes	N/A	N/A
M-2001C - Base-R	Yes	N/A	N/A	N/A
M-2001C – Base-RS	Yes	N/A	N/A	N/A

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	Surface Mount Models with Suffix "T" when Auxiliary CT Replacement Not Needed	**M-2278**
AVE, GEC		
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Reinhausen		
	MK20	**M-2220**
	MK30	**M-2230**
Westinghouse		
	SVC, SVR	**M-2067**
	MS-TM Panel	**M-2286**
	SJS	**M-2326**
	Control for URS Tapchanger	**M-2357**
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	Type UJ-1	**M-2347**
Cooper (McGraw-Edison/Cooper)		
	CL-2, CL-2A, CL-4A, CL-4B, CL-4C, CL-5A, CL-5C, CL-5D, CL-5E, CL-6	**M-2355B**
General Electric		
	ML-32, VR-1, SM1, SM2, SM-2A, SM-3 (Solid-State Type)	**M-2293B**
	ML-32 (Balance-Beam Type)	**M-2264B**
	ML-32 (Balance-Beam Type - "Bubble Gum Machine")	**M-2356B**
Howard Industries/I.C.M.I.		
	UVR-1	**M-2301A**
Pennsylvania McGraw-Edison		
	Pole Star Hinge Pins on left of cabinet	**M-2345A**
	Pole Star Hinge Pins on right of cabinet	**M-2324B**
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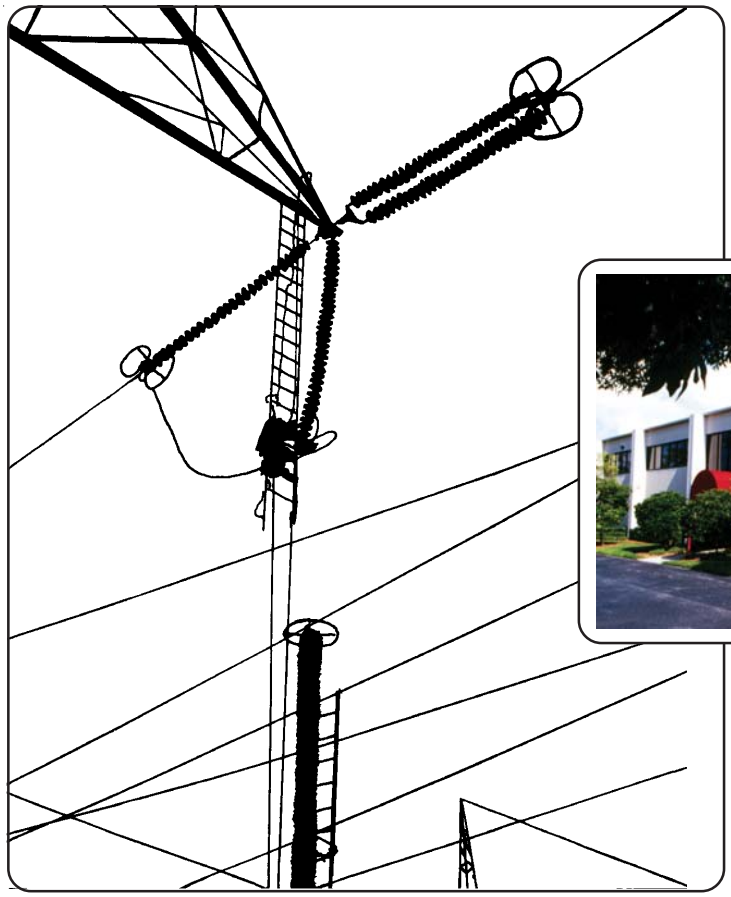
Westinghouse		
	SJS	**M-2326**
	SVC, SVR	**M-2067**
	URL	**M-2323**



ISO 9001:2000
Registered

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Rev. 101906-1