

Installation Instructions
and Functional Description

MicroVersaTrip® RMS-9 Programmer

For Replacement of
MicroVersaTrip® 9 Function

Programmiers in AKR and
Power Break® Breakers

I. INTRODUCTION

The MicroVersaTrip® RMS-9 programmer is the state of the art solid state over current protection programmer for Industrial circuit breakers. The MicroVersaTrip® RMS-9 programmer includes a digital microprocessor for direct RMS sensing of sinusoidal or harmonic power distribution currents.

This new generation of MicroVersaTrip® RMS-9 programmers is compatible with the old MicroVersaTrip MVT-9 system. With minor changes, the MicroVersaTrip programmer can be replaced by the RMS-9. Specific instructions on page 2 through 4 describe how to replace MicroVersaTrip with MicroVersaTrip RMS-9 programmers on Power Break and AKR circuit breakers. A detailed description of the MicroVersaTrip® RMS-9 programmer functions is contained on pages 4 through 7.

For Power Break and AKR breakers, the current sensors and flux shifters used for the MicroVersaTrip® RMS-9 programmers are identical to the ones used for the MicroVersaTrip® programmer.

The MicroVersaTrip® RMS-9 programmer may be installed in circuit breakers with the following frame and programmer designations:

	Frame Description	Old Programmer Type Prefix
Power Break Circuit Breakers:	TPV, TPVV, THPV, THPVV, TCV, TCW, THCV, THCVV	TP4VT20, 25, 30, 40, TP9VT20, 25, 30, 40
AK/AKR Circuit Breakers	AKR-30, AKR-30S, AKRU-30, AKR-30H, AKR-50, AKRT-50, AKR-75, AKR-100, AK-75, AK-100	TA9VT20, 32, 40

II. PROGRAMMER REPLACEMENT

A MicroVersaTrip® RMS-9 programmer intended to replace a MicroVersaTrip® 9 programmer rating plug is shipped from the factory with the fixed non-interchangeable rating plug. On breakers with fixed or tapped sensors, the rating of the breaker cannot be changed by installing a different rating plug. Breaker rating can be changed on breakers with tapped sensors by connecting the tap lead to the desired tap.

A. J and K Frame Circuit Breakers

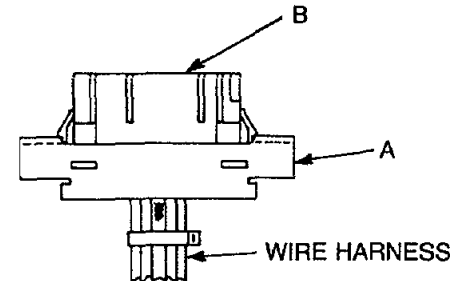
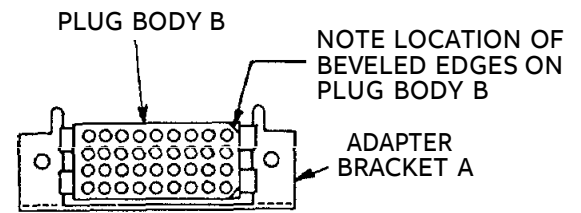
MicroVersaTrip® RMS-9 replacement programmers are not available for j and K frame breakers originally equipped with MicroVersaTrip® 9-function programmers. These breakers may be repaired, however, by contacting:

ABB Inc.
305 Gregson Drive
Cary, NC 27511.
electrification.us.abb.com

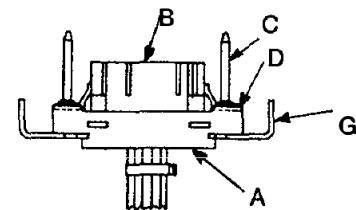
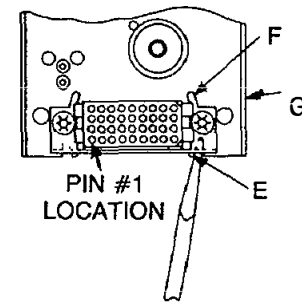
B. Power Break Circuit Breakers 800-2000A Frames

1. Disconnect power to the circuit breaker.
CAUTION: ALL METAL PARTS OF THE INTERNAL MECHANISM ARE ALWAYS LIVE WHEN BOTTOM OR REVERSE FED, EVEN IN THE "OFF" POSITION.
2. Open the breaker by pushing the red OFF button on the front of the breaker cover. On draw out breakers, rack out the breaker all the way.
3. If present, remove line shield.
4. Remove breaker cover.
5. On right side of the programmer, push the **PROGRAMMER RELEASE LEVER** toward the programmer and lift the programmer out. The lever will swing out preventing reassembly of the cover until a programmer is installed.

CAUTION: DO NOT ATTEMPT TO REPLACE A MICROVERSATRIP® PROGRAMMER WITH THIS MICROVERSATRIP® RMS-9 PROGRAMMER WITHOUT USING THE ADAPTER BRACKET PROVIDED; ELECTRICAL CONNECTIONS FROM WIRE HARNESS CONNECTOR TO PROGRAMMER WILL NOT BE MADE WITHOUT THE USE OF THE SUPPLIED SPACER.



PROGRAMMER HARNESS PLUG SUB-ASSEMBLY



PROGRAMMER HARNESS PLUG TO PROGRAMMER BRACKET

1. PUSH ADAPTER BRACKET (A) OVER NOTCHES IN END OF PLUG BODY (8).
2. PULL WIRE HARNESS BRACKET ASSEMBLY UP OVER GUIDE PINS (C) AND PUSH ALL THE WAY DOWN.
3. PRESS ON PUSH NUTS (D) UNTIL ADAPTER BRACKET (A) IS HELD FIRMLY AGAINST PROGRAMMER BRACKET (G).
4. HOLD PLUG BODY FIRMLY IN PLACE AND BEND LOCKING TABS (E) BOTH SIDES.
5. HOLD PLUG BODY TIGHT TO THE ADAPTER BRACKET AND BEND OVER (2) LOCKING TABS (F).

Figure 1. Harness Connector

6. Straighten out the two metal locking tabs on the bottom of the mounting plate that hold the connector in place **NOTE POSITION OF THE POLARIZING BEVELS ON THE CONNECTOR.**
 7. Slide out the connector from the mounting plate.
 8. Refer to Figure 1 and follow steps (1) through (5) to assemble adapter bracket to harness plug (connector) and harness plug to programmer mounting bracket.
 9. Install the RMS-9 programmer on the mounting plate and lock it in place by pushing in the programmer locking lever on the right side of the programmer.
 10. Set programmer switches for each function to the desired settings. (Most likely the same settings as used on the original programmer will be used).
 11. Install the breaker cover (and line shield, if applicable).
 12. Test the breaker for proper operation by using ABB/GE Brand test Kit Cat. No. TVRMS or a commercially available high current test set. See paragraph II. D 11.
- C. 2500-4000A Frames
1. Disconnect power to the circuit breaker.
CAUTION: ALL METAL PARTS OF THE INTERNAL MECHANISM ARE ALWAYS LIVE WHEN BOTTOM OR REVERSE FED, EVEN IN THE "OFF" POSITION.
 2. Open the breaker by pushing the red OFF button on front of the breaker cover. On draw-out breakers, rack out the breaker all the way.
 3. Remove the escutcheon plate over the programmer.
 4. Remove breaker cover.
 5. Push the programmer release lever toward the programmer and lift the programmer out. The lever will swing out preventing reassembly of the cover until the programmer is installed.
6. Straighten out the two metal locking tabs on the left side of the mounting plate that hold the connector in place. **NOTE POSITION OF THE POLARIZING BEVELS ON THE CONNECTOR.**
 7. Locate the two programmer mounting plate screws and the two nuts in the sensor shell slots directly under the mounting plate.
 8. Using a small pencil magnet (approximately 0.25 m. diameter) or a similar magnetic tool to hold the nut in the sensor shell from falling out, remove the two programmer mounting plate screws.
 9. Slide out the connector from the mounting plate.
 10. Refer to Figure 1 and follow steps (1) through (5) to assemble adapter bracket to harness plug (connector) and harness plug to programmer mounting bracket.
 11. Using the magnetic holding tool, position the nut in the sensor shell and line 11 up with the hole in the programmer mounting plate. Fasten one mounting plate screw. In a similar manner fasten the other screw.
 12. Install the RMS-9 programmer on the mounting plate and lock it in place by pushing in the programmer locking lever at the bottom of the programmer.
 13. Set programmer switches for each function to the desired settings.
 14. Install the breaker cover, (and line shield, if applicable).
 15. Test the breaker for proper operation by using ABB/GE brand test kit Cat. No. TVRMS or a commercially available high current test set. See paragraph II. D.11.
- D. AKR Circuit Breaker Programmer Replacement
1. Open the circuit breaker.
 2. Disconnect any wire harnesses between the Switchgear and the breaker.
 3. On draw-out breakers, rack out the breaker all the way. On stationary breakers disconnect power to the Circuit breaker.

4. Follow the instructions on the label fastened to the programmer release lever to remove the programmer. There are three types of programmer mounting plates which may be encountered. On one type the lever beneath the programmer is pushed in just as on the Power Break models. A newer mounting system requires pulling the lever out to unlock the programmer. And on a third design the lever wraps around the right side of the programmer and it must be pushed down.
5. Straighten out the two metal locking tabs on the bottom of the mounting plate that hold the connector in place. **NOTE POSITION OF THE POLARIZING BEVELS ON THE CONNECTOR.**
6. Slide out the connector from the mounting plate.
7. Refer to Figure 1 and follow steps (1) through (5) to assembly adapter bracket to harness plug (connector) and harness plug to programmer mounting bracket.
8. Install the RMS-9 programmer on the mounting plate and lock it in place by pushing in the programmer locking lever on the left side of the programmer.
9. Set programmer switches for each function to desired settings.
10. Rack in the breaker and reconnect any wire harness that were disconnected.
11. Test the breaker for proper operation by using ABB/GE portable test kit Cat. No. TVRMS or a commercially available high current test set. For replacement MicroVersaTrip® RMS-9 programmers with the ground fault option, use of the TVRMS test kit will temporarily "defeat" the ground fault function when testing phase overcurrent functions and can be so used in conjunction with a high current test set when testing a single pole of the breaker to avoid unwanted, simulated ground fault tripping. ABB/GE test kit Cat. No. TVTS1 **cannot and must not be used to test MicroVersaTrip® RMS-9 programmers.** MicroVersaTrip® ground fault defeat cable, Cat. No. TVTGD9 cannot and must not be used to temporarily defeat the MicroVersaTrip® RMS-9 programmer ground fault function. **Programmer damage may result.**

III FUNCTIONAL DESCRIPTION

FIXED RATING PLUG

A fixed rating plug is supplied with the MicroVersaTrip® RMS-9 replacement programmer or retrofitting of an old style MicroVersaTrip function programmer. This fixed plug cannot be changed. The plug contains a long-time timing light and houses a test Jack for plugging in a portable test kit, Cat. No. TVRMS. See paragraph D.11 for details.

TRIPPING FUNCTIONS

1. Current Setting-standard.
2. Long Time Pick-up and Delay-standard.
3. Long Time Pick-up Light-standard (mounted in rating plug).
4. Short Time Pick-up-optional (Cat. No. Suffix "S").
5. Short Time Delay-Optional (Cat. No. Suffix "S").
6. Instantaneous Pick - up - optional in AKR breakers, standard for other breakers, Standard Instantaneous (Cat. No. Suffix "I"), Adjustable High range Instantaneous (Cat. No. Suffix "H").
7. Ground Fault Pick-up-optional (Cat. No. Suffix "G").
8. "Ground Fault Delay-optional (Cat. No. Suffix "G").
9. Triple Selective Trip with Fixed High Range Instantaneous-optional in AKR-30S Breakers Only (Cat. No. Suffix "K").
10. Fault Trip Targets-optional Overload and Short Circuit and Ground Fault (Cat. No. Suffix "T1 ") Overload, Short Circuit and Ground Fault (Cat. No. Suffix "T2")
11. Zone Selective Interlock-optional, Ground Fault Only (Cat. No. Suffix "Z1 "), Ground Fault and Short Time (Cat. No. Suffix "Z2")
12. Switchable OFF Instantaneous/Ground Fault optional for **AK/AKR only.** Pick-up functions can be deleted by turning switch to OFF position (Cat. No. Suffix X).

1. CURRENT SETTING

Current setting "C", is the current value the breaker will carry indefinitely without tripping. The value of the current is determined by the product of current setting and the sensor ampere rating.

Settings are .5X, .6X, .7X, .8X, .85X, .9X, .95X and 1.0X for Power Break® circuit breakers. For AK/AKR low voltage circuit breakers, settings are .5X, 6X, .7X, .8X, .9X, .95X, 1.0X and 1.1 X, where X = sensor ampere rating.

2. LONG TIME PICK-UP AND DELAY

The long time pickup is fixed at 110% of the current setting for Power Break circuit breakers and at 100% of current setting for AK/AKR low voltage circuit breakers.

The long time delay trip bands provide the function of withstanding temporary overloads such as motor starting, welding or other overcurrent conditions without interrupting service.

The purpose of the time delay bands is to provide further degrees of coordination and selectivity within a system. The delay bands provide increasing times to trip at any fixed overload current. The bands are marked as follows:

Continuous Current Rating 150-4000 Amps	Typical Time Delay at 600% of Device Setting (nominal time delay)
Band 1	3 seconds
Band 2	6 seconds
Band 3	12 seconds
Band 4	25 seconds

3. LONG TIME PICK-UP LIGHT

Whenever the current reaches 105% of the current setting for Power Break circuit breakers, and 95% for AK/AKR low voltage power circuit breakers, the long time pickup LED located on the fixed rating plug will flash to indicate the approach of the full load condition. When the breaker load current is over the pick-up threshold, the LED will be on continuously (110% of current setting for Power Break, and 100% for AKR breakers.)

4. SHORT TIME PICK-UP

The primary function of the short time pick-up is to allow the breaker to carry a high level of current for a short period of time. This feature provides a further degree of selectivity within a system.

The short time Pick-up settings are the following multiples of current setting: 1.5C, 2C, 2.5C, 3C, 4C, 5C, 7C and 9C.

5. SHORT TIME DELAY

The adjustable short time delay provides further coordination between "upstream" and "down stream" breakers which have the same short time pickup setting.

The I²t IN/OUT section provides further selectivity by placing the I²t section of the short time region in or out. When the switch selection is OUT, the constant time delay bands dictate the short time trip characteristics. When the switch is in the IN position, depending on the magnitude of the fault current, the trip time will be on the I²t section of the curve or the constant time delay section if the fault magnitude is high enough.

These six selections are available for the short time delay function (delay shown at 600% of current settings with pickup set at 5C or lower, nominal trip times).

1. I²t IN minimum delay, .5 seconds on I²t slope.
2. I²t IN intermediate delay, .5 seconds on I²t slope.
3. I²t IN maximum delay, .5 seconds on I²t slope.
4. I²t OUT maximum delay, .42 seconds.
5. I²t OUT intermediate delay, .26 seconds.
6. I²t OUT minimum delay, .13 seconds.

6. INSTANTANEOUS PICK-UP

The instantaneous setting provides immediate (no intentional time delay) interruption of severe overloads, thereby minimizing damage to system equipment. There are three variations possible:

a. NO INSTANTANEOUS

This is available for AK/AKR breaker only.

b. ADJUSTABLE INSTANTANEOUS

The following variations are possible for the different MicroVersaTrip® RMS-9 units. There are several combinations possible depending on the rating of the breaker and whether short time has been selected or not. The combinations are:

- 1.5X, 2X, 3X, 5X, .7X, 9X, 10X, 13X, 15X.
- 1.5X, 2X, 3X, 5X, .7X, 9X, 10X, 13X.
- 1.5X, 2X, 3X, 5X, .7X, 9X, 10X.
- 1.5X, 2X, 3X, 5X, .7X, 9X.
- 1.5X, 2X, 3X, 5X, .7X, 9X, 10X, 13X, 15X, OFF (AKR Only)
- 1.5X, 2X, 3X, 5X, .7X, 9X, 10X, OFF (AKR Only)
- 1.5X, 2X, 3X, 5X, .7X, 9X, OFF (AKR Only)

where "X" equals the current sensor rating.

c. HIGH RANGE INSTANTANEOUS

High range instantaneous provides protection and coordination at levels up to the full short time rating of the circuit breaker. High range instantaneous is adjustable from 40% to 100% of the short time rating in four steps of 20% each.

CAUTION: DO NOT ATTEMPT TO INSTALL A PROGRAMMER WITH HIGH RANGE INSTANTANEOUS ON A BREAKER WHICH DID NOT PREVIOUSLY HAVE IT.

7. GROUND FAULT PICK-UP

Settings are adjustable with no setting exceeding 1200 Amps to comply with National Electrical Code, Section 230-95.

These settings are the following multiples of sensor Ampere rating (S).

- 150-2000 Amps-.2S, .25S, .3S, .35S, .4S, .45S, 5S, .6S
- 2500A & 3000 Amps-.2S, 22S, 24S, .26S, .28, 30S, .34S, .37S
- 4000 Amps-.2S, .22S, .24S, .26S, 28S, .3S

where S = X = sensor ampere rating.

8. GROUND FAULT DELAY

The adjustable ground fault delay provides further coordination between "upstream" and "down-stream" breakers which have the same ground fault pickup setting.

The I²t IN/OUT section provides further selectivity by placing the I²t section of the ground fault region in or out. When the switch selection is OUT, the constant ground fault delay bands dictate the ground fault trip characteristics. When the switch is in the IN position, depending on the magnitude of the ground fault current, the ground fault trip will be on the I²t section of the curve or the constant ground fault delay section if the fault magnitude is high enough.

These six selections are available for the ground fault delay function (nominal delay shown at 200% of pickup setting):

1. I²t IN minimum delay, .5 seconds on I²t slope.
2. I²t IN intermediate delay, .5 seconds on I²t slope.
3. I²t IN maximum delay, .5 seconds on I²t slope.
4. I²t OUT maximum delay, 42 seconds.
5. I²t OUT intermediate delay, .26 seconds.
6. I²t OUT minimum delay, 13 seconds.

9. TRIPLE SELECTIVE TRIP

Provided on AKR-30s only when long time/short time functions without instantaneous are specified. Provides a fixed high range instantaneous override set at 22KA.

10. FAULT TRIP TARGETS

The mechanical pop-out fault targets identify the type of overcurrent fault (overload, short circuit or ground fault) responsible for tripping the breaker. The target has to be reset manually by pressing it back into the programmer.

11. ZONE SELECTIVE INTERLOCK

The Zone Selective Interlock system allows the breaker sensing the fault to trip immediately. Zone selective interlock is available in two versions: a) ground fault only "Z1" or b) short time and ground fault "Z2". One or more zone

selective interlock modules, Cat. No. TIM1 (120Vac input) or TIM2 (125V dc input) must be used with the zone interlock option. Refer to ABB publication GEK-64467 for connection details and possible rewiring required to accommodate MicroVersaTrip® RMS-9 zone selective interlock, which is different from MicroVersaTrip.

Whenever the downstream breaker goes into ground fault pick-up for "Z1" (and/or short time pick-up for "Z2") and the fault current magnitude I_s in the region where the constant time delay bands are in effect, a signal I_s sent to the upstream breaker, through the zone interlock module.

When the zone selective interlock signal is received, the upstream breaker's delay band is changed from minimum to the one selected by the switch setting for Z1. For a breaker with the Z2 option, both ground fault and short time bands are changed from the minimum to the switch setting.

Note that a programmer with a zone interlock option will time out on the minimum delay band for ground fault for Z1 (and short time for Z2) in the absence of a signal from a downstream interlock module. The switch settings are relevant only when a zone input signal is received.

12. NEUTRAL CURRENT SENSORS (required on a 4-wire system if the programmer has the ground fault protection system.)

The neutral current sensors used with MicroVersaTrip® are the same as those used with MicroVersaTrip® RMS-9 programmers and therefore do not have to be changed.

The neutral sensor can only be used with a breaker whose sensor rating(S) matches the neutral sensor ampere rating or tap setting.

Connect wiring from sensor to breaker black to black and white to white using twisted pair #14 AWG minimum, Belden 8640,61 or 8470,71 or equal.

13. TESTING MICROVERSATRIP® RMS-9 PROGRAMMER

Cat. No. TVRMS is a portable, hand-held, battery powered test kit providing RMS-9 programmer self-tests and functional trip/no trip tests. Interface is via a plug on the front of the programmer and tests can be conducted with breaker in service. Kit uses six rechargeable Nicad or standard alkaline "D" cells supplied by customer. Kit can also be powered by 12-volts ac source. Testing of a MicroVersaTrip® RMS-9 equipped circuit breaker may also be accomplished using primary current from a high current, low voltage-test set. Refer to paragraph I.D.11 for testing options.

These instructions do not cover all details or variations in equipment nor do they provide for every possible contingency that may be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise that are not covered sufficiently for the purchaser's purposes, the matter should be referred to the ABB Inc.

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