



Approvals

Speed Relay Digital Speed Monitor

Part Number: USR1V4, USR1V46

REV121723



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4B appreciates your business and is pleased you have chosen our products to meet your needs.

Please read in its entirety and understand the literature accompanying the product before you place the product into service. Please read the safety precautions carefully before operating the product. With each product you purchase from 4B, there are some basic but important safety considerations you must follow to be sure your purchase is permitted to perform its design function and operate properly and safely, giving you many years of reliable service. Please read and understand the Customer Safety Responsibilities listed below. Failure to follow this safety directive and the Operation Manuals and other material furnished or referenced, may result in serious injury or death.

SAFETY NOTICE TO OUR CUSTOMERS

- A. In order to maximize efficiency and safety, selecting the right equipment for each operation is vital. The proper installation of the equipment, and regular maintenance and inspection is equally important in continuing the proper operation and safety of the product. The proper installation and maintenance of all our products is the responsibility of the user unless you have asked 4B to perform these tasks.
- B. All installation and wiring must be in accordance with Local and National Electrical Codes and other standards applicable to your industry. (Please see the article "Hazard Monitoring Equipment Selection, Installation and Maintenance" at <u>www.go4b.com/usa</u>). The installation of the wiring should be undertaken by an experienced and qualified professional electrician. Failure to correctly wire any product and/or machinery can result in the product or machine failing to operate as intended, and can defeat its design function.
- C. Periodic inspection by a qualified person will help assure your 4B product is performing properly. 4B recommends a documented inspection at least annually and more frequently under high use conditions.
- D. Please see the last page of this manual for all warranty information regarding this product.

CUSTOMER SAFETY RESPONSIBILITIES

1. READ ALL LITERATURE PROVIDED WITH YOUR PRODUCT

Please read all user, instruction and safety manuals to ensure that you understand your product operation and are able to safely and effectively use this product. If the

equipment is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.

2. YOU BEST UNDERSTAND YOUR NEEDS

Every customer and operation is unique, and only you best know the specific needs and capabilities of your operation. Please call the 24-hour hotline at 309-698-5611 for assistance with any questions about the performance of products purchased from 4B. 4B is happy to discuss product performance with you at any time.

3. SELECT A QUALIFIED AND COMPETENT INSTALLER

Correct installation of the product is important for safety and performance. If you have not asked 4B to perform the installation of the unit on your behalf, it is critical for the safety of your operation and those who may perform work on your operation that you select a qualified and competent electrical installer to undertake the installation. The product must be installed properly to perform its designed functions. The installer should be qualified, trained, and competent to perform the installation in accordance with Local and National Electrical Codes, all relevant OSHA Regulations, as well as any of your own standards and preventive maintenance requirements, and other product installation information supplied with the product. You should be prepared to provide the installer with all necessary installation information to assist in the installation.

4. ESTABLISH AND FOLLOW A REGULAR MAINTENANCE AND INSPECTION SCHEDULE FOR YOUR 4B PRODUCTS

You should develop a proper maintenance and inspection program to confirm that your system is in good working order at all times. You will be in the best position to determine the appropriate frequency for inspection. Many different factors known to the user will assist you in deciding the frequency of inspection. These factors may include but are not limited to weather conditions; construction work at the facility; hours of operation; animal or insect infestation; and the real-world experience of knowing how your employees perform their jobs. The personnel or person you select to install, operate, maintain, inspect or perform any work whatsoever, should be trained and qualified to perform these important functions. Complete and accurate records of the maintenance and inspection process should be created and retained by you at all times.

5. RETAIN AND REFER TO THE OPERATION MANUAL FOR 4B'S SUGGESTED MAINTENANCE AND INSPECTION RECOMMENDATIONS

As all operations are different, please understand that your specific operation may require additional adjustments in the maintenance and inspection process essential

to permit the monitoring device to perform its intended function. Retain the Operation Manual and other important maintenance and service documents provided by 4B and have them readily available for people servicing your 4B equipment. Should you have any questions, please call the 24-hour hotline number 309-698-5611, contact your local distributor, or use one of the contact ways available in our website <u>www.go4b.com/usa</u>.

6. SERVICE REQUEST

If you have questions or comments about the operation of your unit or require the unit to be serviced please call the 24-hour hotline number 309-698-5611, contact your local distributor, or use one of the ways available in our website <u>www.go4b.com/usa</u>. Please have available product part numbers, serial numbers, and approximate date of installation. In order to assist you, after the product has been placed into service, complete the online product registration section which is accessed via our website <u>www.go4b.com/usa</u>.



Moving parts can crush and cut.

Lockout power before removing guard or servicing.

Do NOT operate with guard removed.

PRODUCT OVERVIEW

The Speed Relay is a microprocessor controlled digital speed monitor for use with 2, 3, or 4 wire NPN/PNP sensors or Contact sensor inputs, with a user programable electromechanical relay and PhotoMOS Solid State Relay (SSR) outputs. The Speed Relay has a 160x80 pixel LCD display to provide information, and 3 front panel buttons to program settings.

The Speed Relay reads input pulses and displays the calculated pulse frequency in a range of selectable units.

The user can set the Electromechanical Relay and PhotoMOS Solid State Relay outputs independently, with their own thresholds and output behaviors, and have the Alarm LED indicate the state of one of the outputs. The Electromechanical Relay can be set to trigger when the input speed is outside the chosen range. The PhotoMOS Solid State Relay can provide a trigger output or can be configured to provide a pulsed output that matches the input pulse frequency.

One LED (Input LED) shows input status of the sensor's pulses, and another LED (Alarm LED) shows the state of the assigned output.

PACKAGE CONTENT

1x Speed Relay

SPECIFICATIONS

Supply Voltage	+24VDC (+18 to +28 VDC), 80 mA MAX at 24 VDC
	230 VAC (85 to 264 VAC), 50-60 Hz, 35 mA MAX at 230 VAC
Available Sensor Power	24 VDC, 100 mA when powered via mains.(2-Wire NPN sensors powered from terminal 4 can draw a maximum of 50mA)Note: Make sure that the sensor used with the Speed Relay works within the available sensor power.
Terminal Entry	2.5 mm2 / 12 AWG
C/O Relay Contacts*	30 VDC / 250 VAC, 2.5 A MAX
SSR Output Contacts**	230 V AC/DC, 100 mA
Interlock Input	18 to 28 VDC / 85 to 264 VAC
Indication	1x Red Alarm LED 1x Green Input LED 1x 160x80 LCD display
Sensor Input Frequency Range	0.1 Hz to 1000 Hz
Max Frequency Represented using SSR Output	500 Hz
Pulse Ratio	1 to 1024
Operating Temperature	-20 °C to 50 °C (-4 °F to 122 °F)
Dimensions	115mm(H) X 45mm(W) X 80mm(D) (4.5in x 1.8in x 3.1in)
Fixing Centres	35mm DIN rail clip
Enclosure	ABS/PC
Protection	IP20
Weight	200g / 0.44lb

*Terms used interchangeably: Electromechanical Relay, Relay

**Terms used interchangeably: SSR Output, Solid State Relay



In Process

DIMENSIONS

ALL DIMENSIONS IN MM



1. The supply circuit of the system to which the equipment is connected shall be protected by a suitably rated fuse capable of interrupting a prospective short circuit current of 1.5 kA.

STANDARD WIRING DIAGRAM

All wiring must be in accordance with local and national electrical codes (e.g. NEC, CEC, EN IEC 60079-14) and should be undertaken by an experienced and qualified electrician.

All wiring must be in accordance with local and national electrical codes and should be undertaken by an experienced and qualified electrician. The unit connections and typical wiring diagrams are given in figures 6.1 to 6.10. The Relay, SSR Output and Interlock contacts are voltage free.



For the USR1V4 Version, terminals 7,8, and 9 are N/C (NOT CONNECTED).

Terminal	Description	Rating	
1	+VDC	Input: +18 to 28 VDC, 80 mA (50 mA for 2-wire NPN sensor) OR	
		(USR1V46 Only) Output: +24 VDC, 100 mA, when powered by AC Input	
2	OVDC	0 VDC	
3	PNP Sensor Input	Input: +18 to 28 VDC	
4	NPN Sensor Input	Output: +24 VDC, 50 mA	
5	SSR Output A		
6	SSR Output B	Input: 230 V AC/DC, 100 MA	
7	Earth	(USR1V46 Only)	
8	AC Neutral	Input: 85 to 264 VAC, 50 to 60 Hz, 0.03A	
9	AC Live	at 230 VAC	
10	Output Relay COM		
11	Output Relay N/C	Input: 30 VDC/250 VAC, 2.5 A MAX	
12	Output Relay N/O		
13	Interlock A	Input: 18 to 28 VDC / 85 to 264 VAC	
14	Interlock B		

2-Wire sensors such as P1003V10AI and P3003V10AI



2-Wire NPN Sensor Wiring

2-Wire PNP Sensor Wiring

3-Wire sensors such as types E (NPN), E2 (PNP), and E3 (NPN/PNP) Rotech Encoders



3-Wire NPN Sensor Wiring

3-Wire PNP Sensor Wiring

4-Wire sensors such as P1003V34AI, P3003V34AI and P8001V34FC



4-Wire NPN Sensor Wiring

4-Wire PNP Sensor Wiring



The USR1V46 Speed Relay can be powered from an AC source or a DC source. If the Speed Relay is powered via AC using terminals 7,8, and 9, then the Speed Relay provides a +24 VDC supply from pin 1 to power a sensor which is rated for 100 mA.

A 2 wire NPN sensor can be powered from Terminal 4 which is rated for 24 VDC, 50 mA.

If the Speed Relay is powered via DC using terminals 1 and 2, then the sensor should be powered from the same supply.

Ensure all connections are correct before applying power.

The speed relay can only operate with a single sensor at a time, do NOT attach more than one sensor simultaneously.



Interlock Wiring

When the interlock setting is set to "USED" the Interlock must be connected for outputs to trigger. When the Interlock is connected and the start-up delay has elapsed, the symbol RUN is displayed at the top of the runtime screen.

When the interlock setting is set to "NOT USED" the state of the interlock does not matter.

INSTALLATION

The Speed Relay should be wired as show in the connection diagrams in Electrical Setup.



Speed Relay Mounted on 35mm DIN rail

The Speed Relay should be mounted on a 35mm DIN rail in suitable enclosure of protection rating IP40 or above. The enclosure door should be kept locked when the system is in operation.

Use a small flathead screwdriver to lower the hook on the rear of the Speed Relay to install or remove the device.



Mounting Speed Relay with Screwdriver

GRAPHICAL USER INTERFACE

Splash Screen



Description: Initial screen displayed for 4 seconds on start-up before transitioning to the runtime screen.

Contents: Device Name, 4B Logo, Version Number.

Controls: None.

Runtime Screen



Description: Main screen during use. The Maximum value displayed on the screen is 99,999, or 999.9 when displaying values with decimals.

Alarm Icon (ALM) is displayed when the Alarm LED is triggered, the background also becomes red. Stop Icon (STP) is displayed when the Relay output is triggered. Start-up icon (SUD) is displayed during the start-up period. Run icon (RUN) is displayed in place of start-up icon when the system has the Interlock connected and the start-up delay has elapsed (or if the interlock is not being used).

Contents: Alarm Icon (ALM), Run Icon (RUN), Stop Icon (STP), Start-up Icon (SUD) Speed in digits, Units.

Controls: Enter button – Transitions to the main menu.

Main Menu



Main Menu

Description: Menus used to navigate through and select settings for the speed relay.

Contents: Scroll list, Selected Item Indicator.

Controls:

Up button – scrolls the current list up one.

Down button – scrolls the current list down one.

Enter button – activates the selected option.

Options	Details
1.Units	Cycles through the selected unit. PPM, Hz, RPM, FPM, MPS, %
1b.Scale Value	Only displayed when Units are FPM or MPS. Transitions to the
	scale value screen
1b.100%=	Only displayed when Units is %. Transitions to the Calibration point screen
2.No. of Targets	Transitions to the Number of Targets screen
3.Start Delay	Transitions to the Start Delay Screen
4.Interlock	Toggles between USED, and NOT USED
5.RELAY	Transitions to the threshold menu for the Relay output
6.SSR OUTPUT	Transitions to the threshold menu for the SSR output.
7.ALARM LED	Transitions to the threshold menu for the alarm LED output.
8.Latching	Toggles between ON, and OFF
9.Output Delay	Transitions to the Output Delay screen
10.Save Profile	Transitions to the Save Profile Screen
11.Load Profile	Transitions to the Load Profile Screen.
12.Test Outputs	Transitions to the Test Screen
13.Manual QR	Transitions to the QR code screen
code	
14.Factory Reset	Transitions to the Factory Reset Screen
15.Screen Sleep	Cycles through the screen sleep delay settings. Never, 1 minute,
40 T	5 minutes, 10 minutes, 30 minutes, 60 minutes.
16.1emp	Displays the current unit temperature.
17.Version	Displays the version number
Confirm	Saves all currently selected settings and transitions to the
	runtime screen
Cancel	Discards any selected but not saved settings and transitions to
	the runtime screen

NOTE: When changing units in the Units Menu, ensure the output setpoints are at the desired values in relation to the new units.

Scale Value Screen



Description: The screen for setting the scale value for MPS and FPM units (i.e. the distance 1 pulse is equal to.)

Contents: Scale title, digit selection indicator, scale value, units.

Controls:

Up button – Increases the selected digit by 1, to a maximum value of 99.99.

Down button – Decreases the selected digit by 1, to a minimum value of 0.

Enter button – selects the next digit or confirms the scale value and transitions back to the menu screen if the last digit is already selected.

Calibration point Screen



Calibration point Screen

Description: The calibration point screen allows the user to select a value in PPM for to be equal to 100% speed.

Contents: 100% Speed text, selected digit indicator, calibration point value, PPM

Controls:

Up button – increases the selected digit by 1, to a maximum PPM of 60000

Down button - decreases the selected digit by 1, to a minimum PPM of 0

Enter button – selects the next digit or confirms the calibration point and returns to the system menu.

Number of Targets Screen



Number of Targets

Description: The screen for setting the number of targets equal to 1 pulse (i.e. the number of input pulses it takes to register as 1 pulse.)

Contents: Screen title, digit selection indicator, number of targets.

Controls:

Up button – Increases the selected digit by 1, to a maximum of 1024.

Down button – Decreases the selected digit by 1, to a minimum of 1.

Enter button – selects the next digit or confirms the number of targets and transitions to the menu screen if the last digit is already selected.

Threshold Menu



Threshold Menu

Description: The threshold menu is used to select the settings for the chosen output, each output has its own settings.

Contents: Scroll list, selected item indicator.

Controls:

Up button – scrolls the current list up one.

Down button – scrolls the current list down one.

Enter button – activates the selected option.

Details		
Cycles through the selectable options for the current output.		
Relay	Range	The Relay triggers outside the selected range
	Range	The SSR Output triggers outside the selected range
SSR	Relay	SSR Output uses the settings for the relay
Output	Follow	output.
	Pulse	SSR Output pulses at the measured input
		frequency.
	Relay	Alarm LED uses the same settings as used
	follow	for the relay output.
Alarm LED	SSR follow	Alarm LED uses the same settings as used for the SSR output. Note: if the SSR output is set for Pulse, the Alarm LED will be off for this option
Toggles between the output states for when the output it		
triggered ENG – Energised		
D-Eng – Deenergised		
Minimum threshold – transitions to the setpoint screen for the		
minimum threshold for the current output.		
Maximum threshold – transitions to the setpoint screen for the		
maximum threshold for the current output.		
NOTE: Min and Max will automatically sort themselves when		
values are entered.		
	Details Cycles thr Relay SSR Output Alarm LED Toggles b triggered. D-Eng – [] Minimum Maximum Maximum NOTE: Mivalues are	Details Cycles through the Relay Range Range Range SSR Relay Output Follow Pulse Relay Alarm SSR LED SSR follow SSR Toggles between triggered. ENG – I D-Eng – Deenergi Minimum threshold Maximum threshold Maximum threshold Maximum threshold MoTE: Min and M values are entered

Back Transitions back to the main menu.

Setpoint Screen (Min and Max Settings)



Setpoint Screen

Description: The setpoint screen allows the user to select a value for a selected threshold.

Contents: Setpoint title, selected point, selected digit indicator, setpoint value, units, percentage equivalent*.

* Percentage equivalent is only visible if the selected unit is %.

Controls:

Up button – increases the selected digit by 1, to a maximum PPM of 60000 (or unit equivalent.)

Down button – decreases the selected digit by 1, to a minimum PPM of 0 (or unit equivalent.)

Enter button – selects the next digit or confirms the set point and returns to the threshold menu.

Delay Screen



Delay Screen

Description: The Delay screen lets the user set either the Output Delay or Start Delay values.

Output Delay – The time between an outputs trigger being met and the output triggering. If the input returns to a non-triggering state before the delay period is exceeded, then the output will not trigger.

Start Delay – The time between the powering on of the Speed Relay (or inputting the Interlock), and the point at which the Speed Relay starts evaluating the output conditions.

Contents: Delay title, selected digit indicator, delay value.

Controls:

Up button – increases the selected digit buy 1, to a maximum of 100 seconds.

Down button – decreases the selected digit by 1, to a minimum of 0 seconds.

Enter button – selects the next digit or confirms the delay and transitions to the system menu.

Factory Reset Screen



System Reset Screen

Description: The factory reset screen allows the user to wipe all user settings from the Speed Relay. All saved settings will return to the default values.

Contents: Factory reset warning, selected item indicator, setting option.

Controls:

Up button – cycles between cancel and confirm.

Down button – cycles between cancel and confirm.

Enter button – confirms the selection and transitions to the runtime screen if confirm was selected, or transitions back to the system menu if cancel was selected.

Profile Screen



Settings Screen

Description: The Profile screen allows the user to either save the current settings to the device or load a previously stored profile.

Load profile screen: The user has the option of selecting one of three previously saved profiles, a separate default profile (that uses the default values for all settings), and the back option.

Save profile screen: The user has the option to save the current settings profile into one of three profile slots, and the back option.

Contents: Settings title, selected item indicator, setting option.

Controls:

Up button – cycles through the 3 profile slots, the default profile (if on the Load profile screen), and the back option.

Down button – cycles through the 3 profile slots, the default profile (if on the Load profile screen), and the back option.

Enter button – confirms the selected option. On the load screen this will load the selected profile and return to the system menu. And on the save screen, this will save the current settings into the selected profile slot and transition to the system menu.

Test Screen



Test Screen

Description: The Test screen allows the user to test all the outputs by triggering them for 5 seconds so the user can confirm that attached systems respond correctly.

Contents: Test description, selected item indicator, test option.

Controls:

Up button – cycles between the cancel and confirm options.

Down button – cycles between the cancel and confirm options.

Enter button – confirms the selected option. If cancel is selected, then the screen transitions to the system menu. If confirm is selected, then the screen will display the text "TESTING..." for five seconds whilst the outputs turn on, and then the outputs will return to normal, and the screen will transition to the system menu.

Manual Screen



Description: The Manual screen displays a QR code that links to the URL of the product manual.

Contents: QR code.

Controls:

Enter button – Transition to the System menu.

Setting	Function	Values	Default
Units	The display units of the device.	PPM, Hz, RPM, FPM, MPS, %	PPM
Number of Targets	The number of input pulses needed to register as one pulse.	1 – 1024	1
Scale Value	The scaling value for the selected unit.	0-99.99	1.0
Calibration Point	The Calibrated point when % unit is used	0-60,000	100
Output Latching	Whether the output remains latched in its triggered position after being triggered.	ON, OFF	OFF
Output Delay	How long the trigger condition needs to occur before the output triggers.	0.0 – 100.0 s	1.0 s
Start Delay	How long the unit waits after starting up (or turning on the Interlock) before measuring the input against the thresholds.	0.0 – 100.0 s	5.0 s
Screen Sleep Delay	The length of the period of inactivity required for the display to turn off automatically.	1 minute, 5 minutes, 10 minutes, 30 minutes, 60 minutes, Never	Never
Interlock usage	If the Interlock is being used or not.	USED, NOT USED	NOT USED
Relay Option	The use of the relay	Range	Range
Relay Trip State	The relays trip state.	ENG, D-ENG	ENG
Relay Setpoint Min	The first setpoint for the relay output.	0 – 60000 PPM (or unit equivalent)	0 PPM
Relay Setpoint Max	The second setpoint for the relay output.	0 – 60000 PPM (or unit equivalent)	100 PPM
SSR Output Option	The output of the SSR Output.	Pulse, Range, Relay Follow	Pulse

SSR Output Trip	The SSR Outputs trip state.	ENG,	ENG
State		D-ENG	
SSR Output	The first setpoint for the SSR	0 – 60000 PPM	0 PPM
Setpoint Min	Output.	(or unit	
		equivalent)	
SSR Output	The second setpoint for the	0 – 60000 PPM	0 PPM
Setpoint Max	SSR Output.	(or unit	
		equivalent)	
Alarm LED	The output of the Alarm LED.	Relay Follow,	Relay
Option		SSR Follow	Follow
Alarm LED Trip	The Alarm LED trip state.	ENG,	ENG
State		D-ENG	

TROUBLESHOOTING GUIDE

CONDITION	SOLUTION
Display is off	 Check that power is applied to the unit via the appropriate terminals (Either 24 VDC to 1-2 OR (USR1V46 Only) 85 to 264 VAC to 7-8-9.) Check that the display is not in sleep mode by pressing any of the buttons on the front of the device.
Attached sensor is not powered	 Check that the sensor wiring is correct. Check that the sensor is working with another device, replace sensor if faulty.
Input LED does not pulse with sensor input.	 (24 VDC supply) Check that the sensor is powered from the same supply as the unit. (230 VAC supply) Check that the sensor is powered via the 24 VDC output of the unit. Ensure that the sensor is wired into the correct input terminal of the unit. (e.g. NPN sensor wired to the NPN input terminal.) Make sure sensor is outputting pulses correctly.
0 PPM is displayed even though Input LED is flashing	 Make sure that the input pulse frequency is greater or equal to the minimum detectable frequency of the unit. Adjust the pulse ratio to 1 and check again. If in MPS or FPM units, adjust the scale value to 1 and check again. If in % units, adjust the calibration point and check again.
Input pulse has reached trigger condition, but the outputs have not triggered	 Ensure that the Interlock is connected and enabled, and the start up delay has elapsed. (RUN should be displayed at the top of the runtime screen to confirm.) Reset the Interlock by removing and reapplying. Check trigger conditions to ensure they are programmed correctly.
Output trigger toggles rapidly	1. Adjust output delay to avoid rapid switching.

Periodically test the speed relay and the system to ensure that both are operating correctly.

- 1. Check that the unit is correctly installed. (See Electrical Setup)
- 2. Ensure that all cabling is in good state, and that all the electrical connections are secure and in good order.
- 3. Test that the Speed Relay receives input pulses, with the Input LED flashing and a speed calculated on the display.
- 4. Test that the outputs trigger using the Test function in the system settings menu, and that the machine reacts appropriately.

If the system does not immediately shutdown as expected or alarm as required, then remove the machine from service until the problem has been diagnosed and corrected.

NOTES

1. EXCLUSIVE WRITTEN LIMITED WARRANTY

All products sold are warranted by the company 4B Components Limited and 4B Braime Components Limited herein after referred to as 4B to the original purchaser against defects in workmanship or materials under normal use for one (1) year after date of purchase from 4B. Any product determined by 4B at its sole discretion to be defective in material or workmanship and returned to a 4B branch or authorized service location, as 4B designates, shipping costs prepaid, will be, as the exclusive remedy, repaired or replaced at 4B's option.

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