AoFrio

USER MANUAL

Universal Programmer (Uniprog)

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Warnings

Please read the following warnings to maintain the safe function and continued performance of your AoFrio Uniprog programmer:

General Safety

- Only suitably qualified and trained personnel should configure or maintain electric motors and fans.
- Suitable safety clothing, protective glasses and equipment must be worn to avoid injury. Loose clothing and jewelry must not be worn around motors, the use of a hair net is advised.
- Before configuration of the motor, the housing and other mechanical parts as well as all cables and connections must be inspected for damage or defects. Do not configure a motor if it is damaged.
- Electrical cables and connections must be checked for damage.
- Consider whether you need to attach fan blades to the motors during configuration as the motors will spin unexpectedly and the fan blades can cause injury.
- A residual current device (RCD) or ground fault circuit interrupter (GFCI) must be used. If you are unsure whether your mains supply has an RCD/GFCI use an in-line RCD/GFCI.
- The Uniprog housing is grounded. However, the Earth terminal on the Uniprog's output socket is not used, as ECR2 motors are double insulated. This terminal is not connected to Uniprog's Earth input. Do not use this terminal for a safety Earth connection.
- Although the black wire on an ECR2 motor is not live when disconnected, it is not safety isolated. The black wire should be assumed to be live at all times and should always be connected to the Uniprog rather than left loose.
- The motor may start unexpectedly when power is first applied or after a delay. Do not assume that a stopped motor is not powered.
- Always be aware of the voltage rating of wires and parts you are using. Avoid using banana cables, crocodile clips and audio jacks as connectors as they are often only rated for 20-40V which is unsuitable.

Warnings for the Quicktest power tester

Suitable connectors must be used for connecting Wellington motors to the Uniprog programmer. This is why AoFrio supplies a CLIFF Electronic Components 3-phase Quicktest power tester with all Uniprog programmers.

The Quicktest power tester should be:

- Used for demonstration and/or small production runs for Wellington motor configuration
- Set up with a disconnect switch for each earth referenced mains voltage connection:
    - Brown – Phase
    - Black – Mains Voltage Signal (also used as phase for two-wire compatible motors)
    - Blue – Neutral

It should NOT be:

- Permanently connected to a test fixture or motor setup.
- Used for programming multiple motors at once. See section on configuring multiple motors in this manual for more detail.

If you have an older style CLIFF Electronic Components 2-phase power tester, do not use this for motor configuration. Contact AoFrio to arrange supply of a 3-phase replacement instead.

Warnings - continued

Safety Considerations for non-standard connectors

- Mains Voltage rated connectors must be used at all times.
- OEMs can make their own connection setup to configure multiple motors at the same time. When custom connection methods are used:
    - AoFrio is not responsible for injuries or damage from unexpected behaviour, effort has been made to ensure that the operator is not exposed to mains voltages however the setup relies on the physical barrier between the operator and mains that is presented by the quick test interface.
    - Follow safety regulations for your region.
    - Use a safety interlock system (like Omron D4NS-4DF), that physically prevents the operator from touching exposed high voltage metal while the enclosure is open.
    - Use an independent protection earth as the Uniprog does not have a protection earth output.

Introduction

The Uniprog programmer is a general-purpose tool for configuring and for manually controlling Wellington ECR2 motors. It provides a connection between the motor and an Android mobile app which is used as a programming/control interface. In as-supplied configuration the Uniprog is intended for laboratory and other one-off or short-run use, however with modifications to the motor connection system it can be used for configuring motors in series production.

Uniprog programmers support:

- Direct control of motor inputs (power and black control wires) from the app
- Direct control of motor speed using AoFrio's Variable Speed Protocol (VSP) (not available for all motor firmware versions)
- Configuration of motor behaviour under different mains wiring connection states (the exact range of behaviour which is configurable depends on motor firmware)
- Simple configuration through power reading to reduce complexity during the process. If a configuration fails, refer to the Troubleshooting section of this manual to find potential solutions.

Motor serial numbers and Firmware

- The motor serial number indicates when the motor was made, with a change as below:
    - Up to 2019 - M7471800000 becomes M7-47-18-00000, M7-week (47) - year (18 = 2018) - 5-digit unique identifier (00000).
    - 2020 onwards - M747A00000 becomes M7-47-A-00000, M7-week (47) - year (A = 2020, B= 2021, C= 2022, D=2023 etc) - 5-digit unique identifier (00000).
- Firmware version (also known as revision or Rev)
    - All motors made after week 47 in 2018 have firmware Rev 8 and their serial numbers are above M7471800000.
    - All motors made before week 47 in 2018 have firmware Rev 4 and their serial numbers are below M7471800000.
    - Firmware Rev 7 was part of a limited release and applies to a smaller number of motors.
- Motors with two wires only have one speed setting. There may be a timed feature in this mode, e.g., reverse on start.
- Motors with three wires may have multiple speed settings depending on how the black control wire is connected.
- The drive shaft of each motor determines whether the direction is clockwise (CW) and counterclockwise (CCW).
- These are the manufacturer part numbers if you need to replace the connected configuration hardware:
    - Amphenol connector (C016 20H003 100 10) for multiple motor configuration with 4 position male plug and strain relief
    - CLIFF Electronic Components Quicktest power tester (QT3) for standard single motor configuration

Pictured: Uniprog connected to CLIFF Electronic Components Quicktest power tester and a Wellington ECR motor.

Set up the ECR Universal Programmer app

1. **Download the latest version of the Uniprog app. -** It's important to have the latest version of the Uniprog app. so you can receive notifications and ensure it works with new hardware.

    - **If you don't have the app** - Scan the QR code to the right or:

        1. Go to the Google Play Store
        2. Search for "ECR Universal Programmer" under AoFrio Technologies (or Wellington Drive Limited)
        3. Download the Android app to your mobile device.

    - **If you have already downloaded the app or it was supplied directly** - Follow the steps above and check that you have the latest version of the app. If you don't have the latest version, please upgrade to the version on the Google Play Store. This may mean you need to uninstall the earlier app.

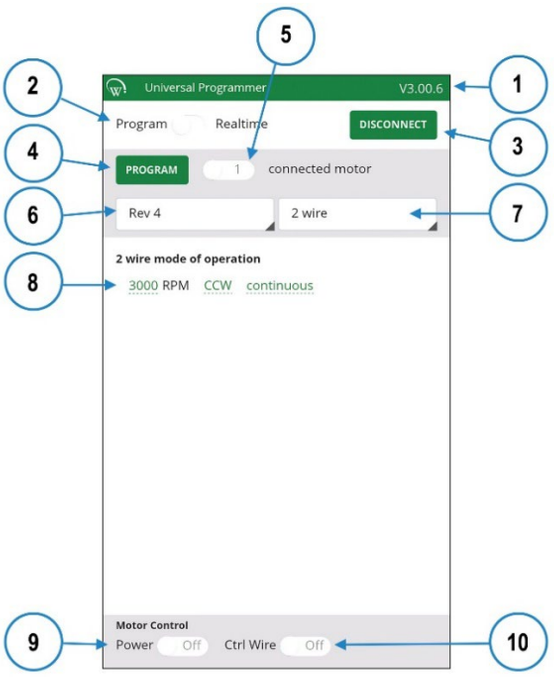
2. **Select a firmware version or revision** - Different motor firmware versions support different configuration settings. The app requires you to select a firmware version, so make sure you know the firmware version of the motor you are trying to configure before attempting to configure it. No harm will be done by attempting to configure for an incorrect firmware version, but the configuration may fail or provide unexpected results. Supported firmware versions are:

    - Version 8: Motors with serial number M7471800000 and higher
    - Version 4: Motors with serial number M7471800000 and lower
    - Version 7: Used for special purposes only.

Universal Programmer app homepage

Each time you log into the app you will see the following information on the homepage.

1. App version number
2. VSP Control Toggle
3. Connect/Disconnect button
4. Program button, to load configurations onto motor
5. Toggle to enable locked rotor to check on multiple motors
6. Firmware selection
7. Wire mode selection, two wire or three wire modes
8. Motor Configuration options
9. Phase output direct control (will turn off after 2 minutes)
10. Control wire direct control



Bluetooth settings and connectivity

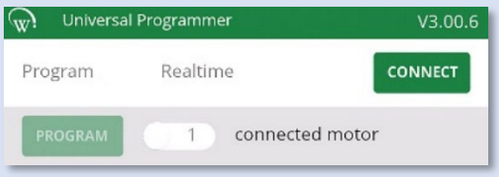
- To connect successfully with Uniprog your mobile device must support Bluetooth 4 (Bluetooth LE) and Android version 4.4 or later (4.5 or later recommended for stable operation). iOS and Windows mobile are not currently supported.
- When connecting check your mobile device's Bluetooth function is turned on and that it is not already connected to another Bluetooth device.
- If there are multiple Uniprog or SCS devices within Bluetooth range of your device, it will help if you hold your device close to the Uniprog during connection. The app will normally put the closest device at the top of the connection list. Shorter numbers normally have the strongest signal. A Uniprog right placed next to your phone should be between -40 to -55 signal strength depending on nearby devices.
- You can only connect to a Uniprog that no one is already connected to.
- Once you are connected, check the Uniprog display screen. A blue light will start to flash in the right-hand top corner of the display.
- If you are having trouble connecting, try the following options:

    - Check that the Uniprog is not already connected to another device
    - Restart the Uniprog by unplugging it then plug it in again.
    - Switch off Data and WIFI on your mobile device then switch them on again.
    - Restart your mobile device.

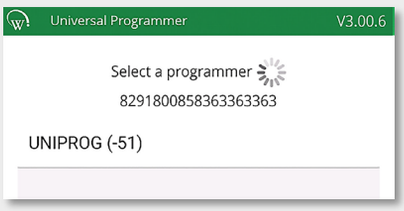
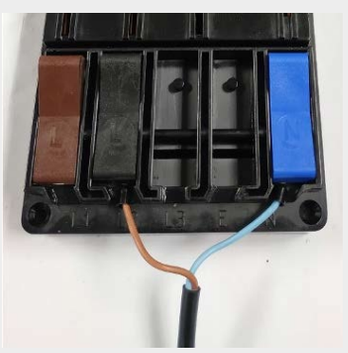
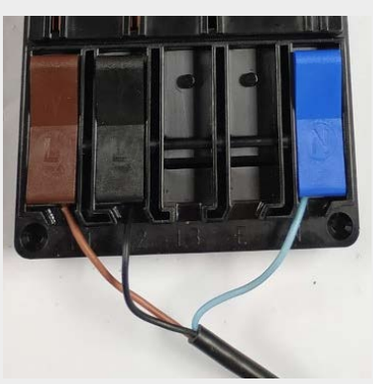
Pictured: Uniprog showing it is connected to Bluetooth with a blue light in top right-hand corner of the display.

Configure a single motor

Hardware setup

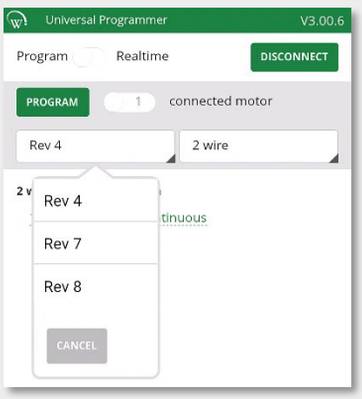
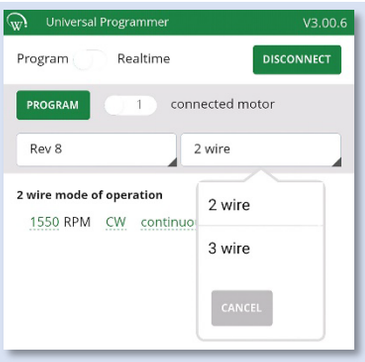
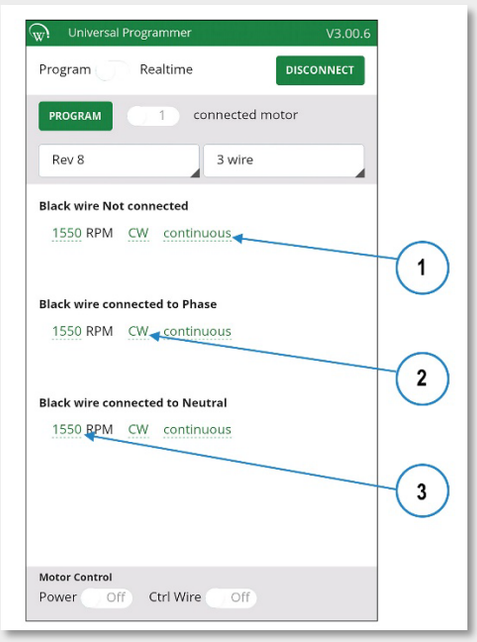
Step	Procedure	Images
1	Connect the Uniprog to a power source and the Quicktest power tester as shown in right-hand image. Input: • IEC Connector 90 – 240Vac • 50 – 60 Hz	 
2	Switch on power for the Uniprog and wait for the screen to display “**ECr”.**	
3	Open the Universal Programmer App on your mobile device.	
4	Hold your phone within Bluetooth range of the Uniprog to allow it to connect to the app.	
5	Tap the **CONNECT** button.	

Configure a single motor - continued

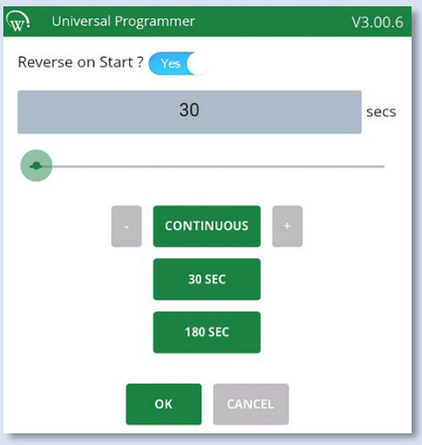
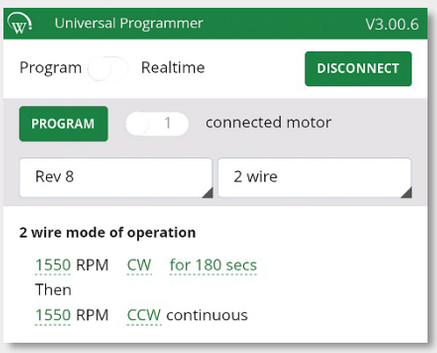
Step	Procedure	Images
6	The app will present a list of nearby Bluetooth devices. Tap the Uniprog model name in the list to connect to it via Bluetooth.	
7	Once you have connected, check the Uniprog display screen. A blue light will start to flash in the right-hand top corner of the display to show it is connected. Note: If your app has confirmed connection and you can't see the blue light, you may be connected to another nearby Bluetooth device.	
8	Connect your motor in either **Two Wire** or **Three Wire** mode. Note: Two wire mode is only available on motors with serial numbers higher than M7471800000 (newer than week 47 in 2018). These motors also have Firmware Version 8.	**Two Wire Mode (FW version 8)**  **Three Wire Mode** 
9	Now that the phone app is connected you can interact with the motor. Follow the configuration or the real-time control instructions.	

Configure a single motor – continued

Configure a single motor with the Uniprog app

Step	Procedure	Notes
1	On the Uniprog app, select the firmware revision to start configuration.	
	Tap the **Revision (Rev) menu field** and select one of the options from the dropdown menu.	
2	Tap on the **Wire mode field** to open the dropdown menu and select either: • **2 wire** • **3 wire**	
3	Set up the motor configuration dependent on the firmware revision and wire mode. You can adjust three fields by tapping on the linked text: 1. **Timed features** - Tap this to enable a timed feature with a maximum time of 1 hour. 2. **Rotation direction** - Tap this to change between CW (clockwise) and CCW (counterclockwise). 3. **Motor speed -** Tap this to change to a different speed	

Configure a single motor - continued

Step	Procedure	Notes
4	(Optional. Not available for v3.02.1) To open the timed feature editor, tap the text next to the motor direction and adjust settings: • **Reverse on start** - slide the selector next to **Reverse on Start?** to "**Yes**". • **Duration** – slide the green dot along the line to a time between 30 seconds up to 1 hour. • **Spin** - tap on the grey +(Plus) or –(Minus) buttons to scroll through the spin options, e.g., Continuous, Stop Then click **OK** to confirm.	
5	Tap the **PROGRAM** button to adjust the motor to the new configuration. Warning: Avoid contact with the wires attached to the hardware. Risk of electrocution!	
6	Wait for the motor to configure. During this time, the: • Motor may pause momentarily in the first few seconds. • Motor may take up to 30 seconds to reach full speed. depending on the load and desired speed. • Mains-rated power outputs will turn on and off multiple times while the motor is being configured. • Lights on the Quicktest power tester will turn on and off during configuration (See picture on right). • Uniprog app will display a message "Programming in progress".	
7	Observe the success or failure message in the app and tap **OK**. If the configuration has: • **Failed** - refer to the Troubleshooting section in this manual for potential solutions. • **Been successful** - remove the motor and attach a new one to continue programming from step 4 above ("Tap the **PROGRAM** button to adjust the motor to the new configuration...". The Uniprog app will use the settings you have selected previously.	

Configure multiple motors

About

It is possible to configure up to 10 three-wire motors at the same time using Uniprog and an Amphenol connector.

For two-wire motors, only one motor can be configured at a time. This is because the motor's power is drawn from the control wire of the Uniprog which only supplies up to 0.4A power. Attaching more than one two-wire motor can damage the Uniprog.

Connect multiple motors to the hardware

- Set up the Uniprog outputs from an Amphenol connector to supply phase, neutral, and control signals to up to 10 motors as follows:
  - **Position 1** = Phase
  - **Position 2** = Neutral
  - **Position 3** = Control Signal, also phase on 2 wire motors (maximum output 0.4A)
  - **Earth** = Not connected. You must connect earth separately as no earth connection is available through the Uniprog.
- Remove the Quicktest power tester from the setup if you never intend to use it.
- Do not exceed the power rating of the input fuse (1A slow blow).
- Avoid attaching fan blades when configuring multiple motors because you will need to test the rotor locks once configuration is complete.
- Consider using a "Safety Interlock System" if you would like to make configuring multiple motors a more permanent solution for your business. See following section for more detail.

How the Safety Interlock System works

This system provides a protective enclosure that automatically disconnects all mains voltages when the enclosure opens so that the operator can interact with the mains terminals without a chance of being electrocuted. The system also works well because the voltage rating (for example D4NS- 4DF, OMERON) remains high enough for configuration. As Wellington motors are already mains rated, you don't need to place the motors inside the interlock box with the Uniprog and Amphenol connector, only the wires connecting to them.

The two most common set ups for this system are:

- a fully plastic (somewhat transparent) enclosure with no conductors going from the inside to the outside
- an earthed metal mesh enclosure

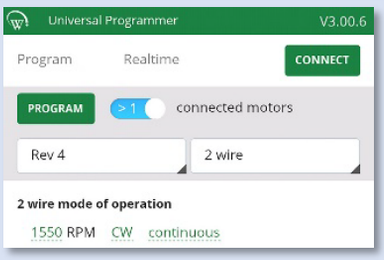
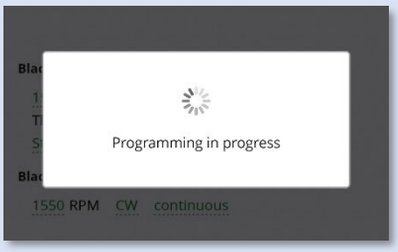
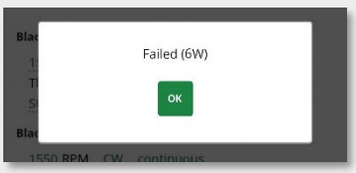
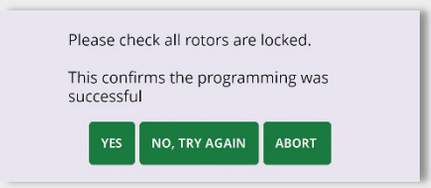
When the system enclosure is closed the operator cannot touch the test setup because they are blocked by the lid of the enclosure. To further protect your team from the risk of electrocution, ensure that you have placed clear signage on the outside of the enclosure showing that mains voltage is present when the lid is closed as there will be mains power connected to the terminals inside.

Additionally, AoFrio recommends that you:

- Always earth metals used on the box of an interlock system. It may be possible to improve the safety of the system further by replacing metal nuts and bolts with plastic variants.
- Set up a 'positive stop' function for the motors to hold them during configuration as they may start to spin.
- Avoid using banana cables, crocodile clips and audio jacks as these are often not the correct rating.
- Avoid attaching fan blades to the motors as you will need to test the rotor lock once configuration is complete.

Configure multiple motors

Configure multiple motors with the Uniprog app

Step	Procedure	Notes
1	On the Uniprog app, slide the selector next to the **PROGRAM** button, from "**1 connected motor**" to "**>1 connected motors**".	
2	Tap the **PROGRAM** button to begin configuration.	
3	Wait for the configuration to complete. You may notice that the motors are spinning slowly or less than full speed.	
4	Once complete, the app will display a message: • **"Success"** - tap **OK** and go to step 5. OR • **"Failed"** - tap **OK** and go to the Troubleshooting section in this manual to look for potential solutions.	 
5	Check that programming is complete for all motors by pressing on the drive flange for each motor. (See picture on right). If all the rotors are locked this means the configuration has been successful.	
6	Proceed as follows depending on the result: • **All motors configured successfully** - tap **Yes**. You can now power off the hardware and attach a new set of unconfigured motors. • **Only some, or no motors failed to configure** – tap **No, try again** and the Uniprog will restart configuration from step 3.	

Troubleshooting

Problem	Possible Cause	Action
Uniprog does not start properly, screen does not show ECR.	Memory problem during update, needs replacement part SCSLXXXX instead of SCSMXXXX	Contact WDTL for replacement of Uniprog device.
	Power switched off early during update firmware update of Uniprog	Contact to WDTL for replacement of Uniprog device.
Cannot Connect to Uniprog.	Phone or PC is old and does not support Bluetooth 4 LE	Check Bluetooth compatibility of phone or PC should have at least Bluetooth 4 and be LE compatible (low energy).
	There is interference on the radio frequency 2.4 GHz	Try disabling data and WIFI on your device. Broadcasting technologies sometimes share an IC so switching off other broadcasting methods can boost the signal of one of them.
		Try to connect to the Uniprog in another location.
Cannot connect to Uniprog after disconnecting from it.	Sometimes disconnection fails	Power cycle the Uniprog to reset it.
Motor does not turn.	No mains power	Check mains power supply.
	Faulty connection	Check power cable connection.
	Thermal protection activated	Allow the motor to cool down and thermal protection to reset.
Motor stops.	Reverse function timed out	This is a possible configuration setting, check the configuration or reconfigure.
Motor fails to start, stalls multiple times.	Fan diameter or pitch too large	Reduce load on motor.
Motor runs in wrong or opposite direction.	Black control wire not connected properly	Check the connection of the black control wire connection.
	App direction set incorrectly	Check the App direction.

Troubleshooting - continued

Problem	Possible Cause	Action
Motor operation doesn't match configuration.	Incorrect 2-wire or 3-wire selection.	Confirm the 2-wire / 3-wire selection matches the motor.
	Uniprog Firmware or App are not up to date.	Check the App you are using is above FW version 3.00.6. If not correct - ask your AoFrio sales rep to upgrade your Uniprog Firmware.
Configuration 'Failed'.	Bad communication.	Retry configuration. Note: This may occur more often with FW revision 4 where the configuration can fail due to interference with communications.
		Remove any cables plugged into the phone or objects blocking the Bluetooth adapter on your PC.
Motor does not turn fast enough after configuration.	Motors have a speed vs torque relationship. If the motor is not spinning fast enough it could be that the maximum output torque has been reached.	Check the motor speed without a fan attached. To find the optimum airflow try using VSP control to directly control the motor speed.
Multiple motors set at the same speed are slow and do not turn at the same speed.	There is some factory variation between motors. The maximum speed vs torque curve is different between motors.	For consistent motor speeds try a smaller fan or reducing the speed. If consistent motor speeds are not important no changes need to be made. The maximum output power is possible at 1800 RPM. Increasing the motor speed towards 1800RPM (e.g., by using a smaller fan) will increase the output power and airflow.

Examples

The following worked examples demonstrate several common configuration scenarios.

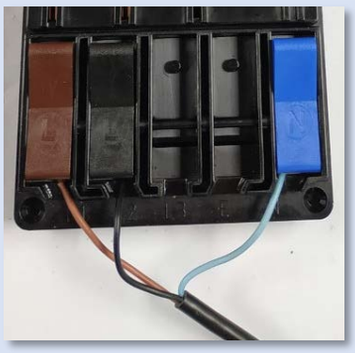
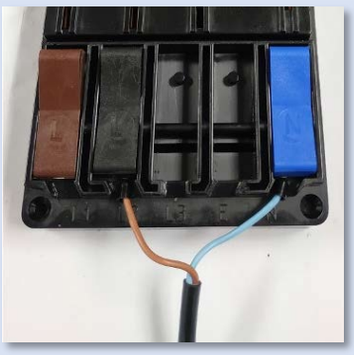
Example 1 – Configuration with Firmware Rev 8

Hardware setup

When configuring with Firmware Rev 8, there are some advanced configuration settings that can:

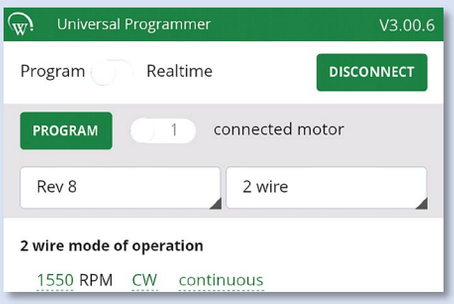
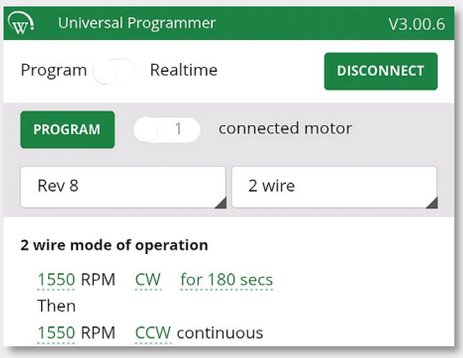
- Detect the difference between the black wire being connected to neutral or not connected.
- Send configuration commands to the motor over the brown phase wire.

To set up your Quicktest power tester, connect the brown phase wire as shown below. If you are configuring more than one motor – you will need to use three-wire mode.

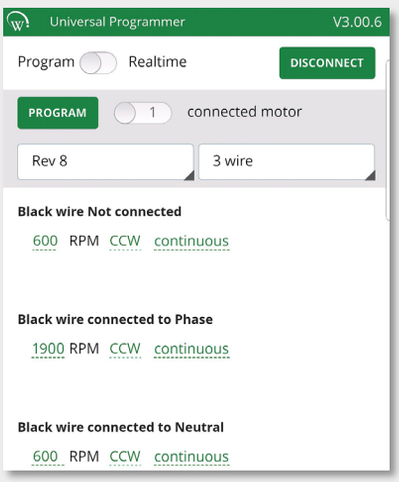
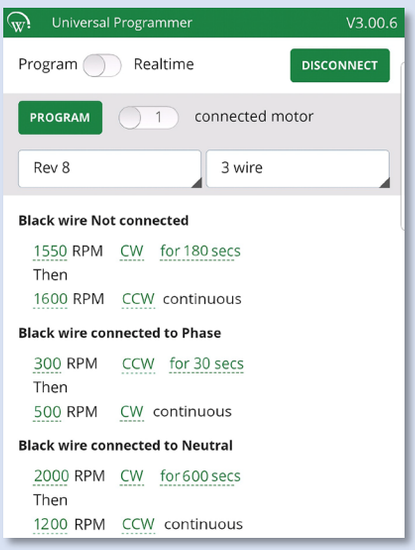
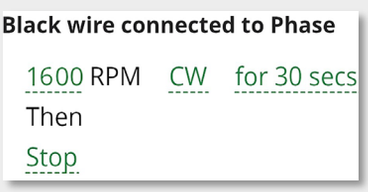
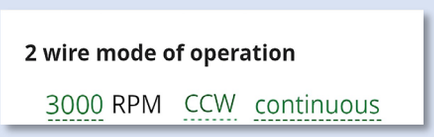
Three-wire mode	Two-wire mode
	

Configuration

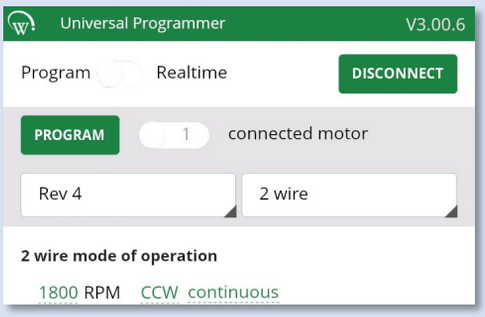
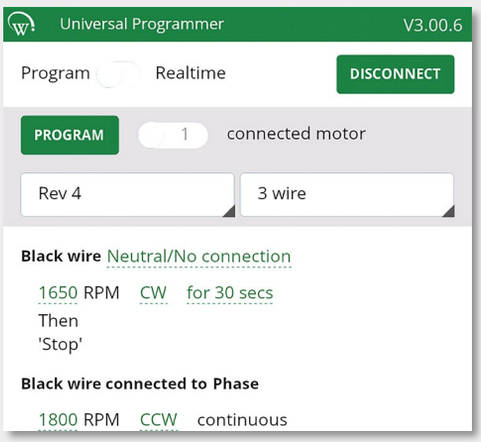
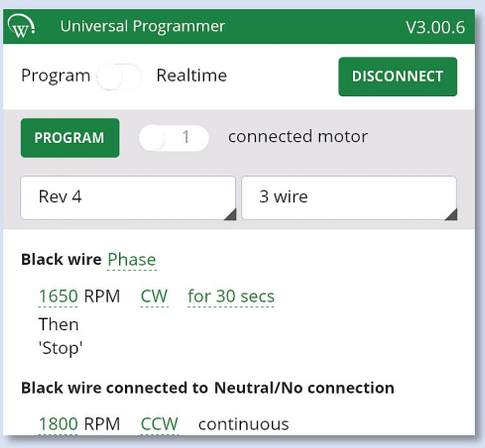
Once you have chosen your wire connections from the Quicktest power tester to the motor, you have the following options depending on the mode and motor settings.

Motor settings	Mode	App screen settings
Continuous operation You can configure continuous operation for Rev 8 in two-wire mode using just the phase and neutral wires. The motor speed will be 1550RPM clockwise.	Two-wire	
Timed delay You can configure timed delay for Rev 8 in two-wire mode using just the phase and neutral wires. The motor speed will be 1550RPM clockwise for 180 seconds then it will change to 1550RPM counterclockwise.	Two-wire	

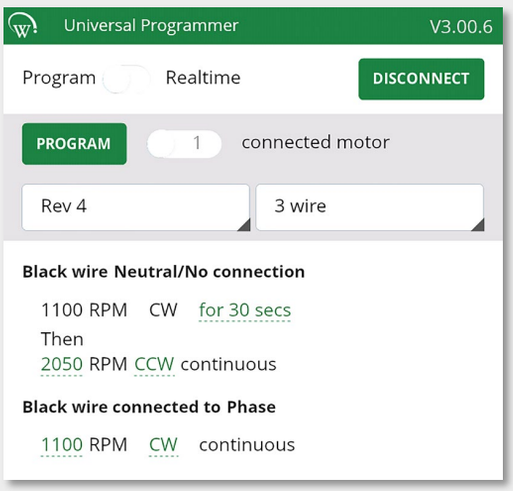
Example 1 – Configuration with Firmware Rev 8 - continued

Description	Mode	Example
Continuous operation You can configure continuous operation for Rev 8 in three-wire mode. These are the motor speed variations and directions depending on how the black wire is connected: • **Not connected** – motor speed is 600RPM counterclockwise • **Connected to phase** – motor speed You can is 1900RPM counterclockwise • **Connected to neutral** - motor speed is 600RPM counterclockwise	Three-wire	
Timed delay You can configure timed delay for Rev 8 in three-wire mode. These are the motor speed variations and directions depending on how the black wire is connected: • **Not connected** – motor speed is 1550RPM clockwise for 180 seconds then 1600RPM counterclockwise • **Connected to phase** - motor speed is 300RPM counterclockwise for 30 seconds then 500RPM clockwise • **Connected to neutral** - motor speed is 2000RPM clockwise for 600 seconds then 1200RPM counterclockwise	Three-wire	
Stop You can use Stop as a motor speed for Rev 8 in three-wire mode. When the black wire is connected to phase the motor speed is 1600RPM clockwise for 39 seconds and then it will stop.	Three-wire	
No speed control You can configure no speed control for Rev 8 in two-wire mode. By setting the motor speed to 3000RPM in either direction the motor will try to go as fast as it can depending on the size of the fan attached.	Two-wire	

Example 2 – Configuration with Firmware Rev 4

Description	Mode	Example
Continuous operation You can configure continuous operation for Rev 4 in three-wire mode with the black wire not connected. The motor speed is 1800RPM counterclockwise. **Note:** Rev 4 needs a 3-wire interface to program	Two-wire	
Timed reverse on NC/Neutral You can configure timed reverse on NC/Neutral for Rev 4 in three-wire mode. In this mode the motor will go for a set time and then stop. Motor speed depends on how the black wire is connected: • **Not connected or connected to neutral** - motor speed is 1650RPM clockwise for 30 seconds then it will stop. • **Connected to phase** – motor speed is 1800RPM counterclockwise.	Three-wire	
Timed reverse on Phase You can configure timed reverse on Phase for Rev 4 in three-wire mode. In this mode the motor will go for some set time and then stop. Motor speed depends on how the black wire is connected: • **Not connected or connected to neutral** – motor speed is 1800RPM counterclockwise. • **Connected to phase** - motor speed is 1650RPM clockwise for 30 seconds then it will stop.	Three-wire	

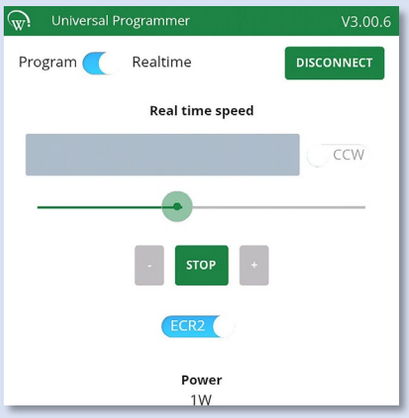
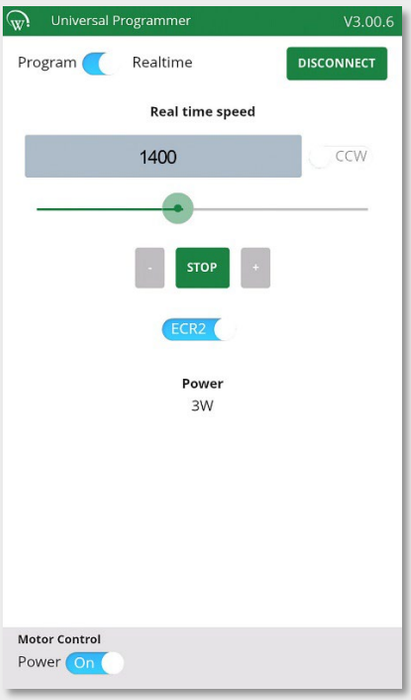
Example 2 – Configuration with Firmware Rev 4 - continued

Description	Mode	Example
Reverse on start You can configure reverse on start for Rev 4 in three-wire mode. In this mode the motor will start at the speed that phase is set to and then change over to the speed that is set for not connected or neutral. Motor speed depends on how the black wire is connected: • **Not connected or connected to neutral** - motor speed starts at 1100RPM clockwise and then after 30 seconds changes to 2050RPM counterclockwise. • **Connected to phase** – motor speed is 1100RPM clockwise. During setup in the Uniprog app, you will need to slide the selector next to **Reverse on Start?** to "**Yes**".	Three-wire	
No speed control You can configure no speed control for Rev 4 in two-wire mode. By setting the motor speed to 3000RPM in either direction the motor will try to go as fast as it can depending on the size of the fan attached.	Two-wire	

Example 3 – Configuration for real-time variable speed control with Firmware Rev 8

In this mode, you can control motor speed directly from a Uniprog. This only works for motors with:

- Firmware revision 8 or newer
- Three-wire mode connection

Step	Procedure	Notes
1	Set up the Uniprog with the Quicktest power tester and connect it to a motor as normal. Open the Uniprog app and connect it to the Uniprog via Bluetooth.	
2	Slide the selector in the Uniprog app from **Program** to **Realtime** to activate VSP Realtime Control. **WARNING!** This will turn on power supply to the Quicktest power tester and connected motor	
3	You will now see the **Real time speed** control menu (pictured right). A rough estimate of output power is displayed in the middle of the page under **Power,** e.g., 1W. This includes power used by the lights in the Quicktest power tester.	
4	Use the app to control the motor configuration in real time. • **Motor speed** – Slide the green dot along the slide bar to adjust the speed or tap the grey speed field and type in a speed. • **Rotation** – Slide the rotation setting between **CW** (Clockwise) and **CCW** (Counterclockwise) • **Spin** - tap on the grey **+**(Plus) or **–**(Minus) buttons to scroll through the spin options, e.g., **CONTINUOUS**, **STOP** • **Phase output** – Under **Motor Control**, slide the power setting to **On** or **Off**. The motor will continue running until the Uniprog device is powered off, or when you tap **DISCONNECT**.	

Universal Programmer (Uniprog) user manual

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