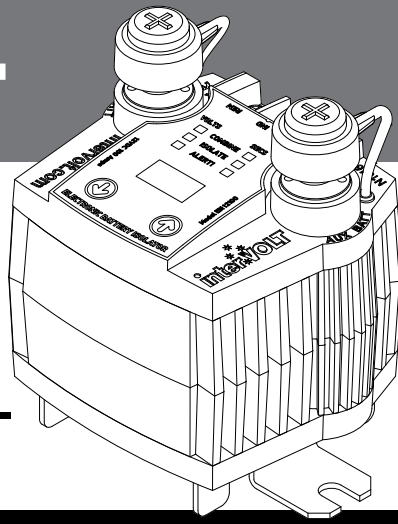


EBI PRO



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Manual No. EBIAUTG1 R1-0

Electronic Battery Isolator – Programmable

Thank you for choosing an interVOLT product...

We at Amelec Australia Pty Ltd are very pleased to introduce you to a very unique and innovative product, the EBI Pro, a contraction of Electronic Battery Isolator - Programmable. The EBI Pro is a first in many ways and as you read through this manual the many features and benefits of this compact little device will be revealed, commencing with the product overview.

Amelec Australia Pty Ltd, a wholly owned and operated Australian private company, is the proud owner of the interVOLT brand, a trademark which is registered in over 20 countries worldwide. We have been producing specialised power conversion products for over 10 years. All our products are designed, developed and assembled in-house at our premises in Perth, Western Australia from both local and imported components.

Our design ethos is based on quality, performance and value and we are committed to product development in the DC power control and conversion field. With roots in the commercial marine, transport, alternate energy and allied industries, we are now branching into the consumer market with dedicated products such as the EBI Pro.

InterVOLT products are designed to cope with the demands of the harshest applications in high temperature and high humidity environments. They are constructed of quality materials (marine grade where applicable) and designed to provide many years of continuous service.

Again, thank you for choosing an interVOLT product and supporting Australian innovation, technology and intellectual property.

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Overview

In short, the EBI Pro is a solid state electronic battery combiner/isolator, fully programmable by the installer/operator and designed specifically for the 4WD and RV automotive market.

The solid state construction is achieved by using high reliability (Hi-Rel) MOSFET transistor technology now becoming increasingly popular in automotive electronic engineering design. This cutting edge technology allows interVOLT's EBI Pro to replace similar electro-mechanical devices which have moving parts and are therefore subject to wear and tear, resulting in short life and premature failure. In addition, the EBI Pro provides the installer/operator with the ability to program specific settings and functions, allowing for complete flexibility in application. This is a feature previously unseen in traditional battery combiner/isolators and sets interVOLT well and truly apart from the competition.

The EBI Pro is generally utilized in any 4WD or RV application where there is a requirement to automatically charge a second (or auxiliary) battery from the starting (or main) battery. This is a well proven concept and is usually only limited by the constraints of the device used in the installation. These constraints have now been overcome by the introduction of the EBI Pro.

This manual contains comprehensive information on the installation, set-up and use of the EBI Pro and is applicable to this model only. Whilst every care has been taken in the preparation of this manual, Amelec Australia Pty Ltd offers no guarantee, express or implied, and accepts no liability for any inaccuracies, errors or omissions in its content. Specifications are subject to change without notice.

There are a myriad of dedicated features built into the EBI Pro. These are expanded upon in greater detail throughout this manual but can be summarised for your reference as follows:

- Completely solid state, no moving parts to ever wear or fail;
- Fully programmable in terms of voltage and time delay functions;
- Clear LED status display and indicators for ease of operation;
- 100 Amps continuously rated with a generous 500 Amps peak;
- Dual sensing allows main battery to be charged from auxiliary;
- Output indicator function for convenient in-vehicle monitoring;
- Input for in-vehicle remote emergency combine switch (starting);
- Overload and short circuit protection with automatic shutdown;
- Over temperature protected with automatic thermal shutdown;
- Low input voltage sensing with automatic shutdown protection;
- Electronics are encapsulated in dust and water proof housing;
- Compact design can be mounted in any position that suits;
- Heavy duty construction designed for under-bonnet installations;
- 24 months warranty (subject to policy terms and conditions).

Application

The EBI Pro is designed for installation in any 4WD or RV with a 12VDC electrical system and a dual battery arrangement.

In a standard dual battery arrangement the system will consist of a starting (or main) battery and a second (or auxiliary) battery. For clarity and conciseness we will refer to these throughout the manual as the main and auxiliary batteries.

An auxiliary battery is generally fitted to provide a standalone source for operating ancillary 12VDC equipment such as winches, refrigerators, inverters, etc. Generally the two batteries are categorised as sources for either factory installed equipment (main battery) or aftermarket installed equipment (auxiliary battery). Regardless, it is not desirable to modify any factory installed wiring and therefore connecting additional 12V equipment to the auxiliary battery is the better option. The auxiliary battery also provides a back-up source for engine starting in the event the main battery is inadvertently drained or simply expires (end-of-life).

It is not desirable to have two batteries connected in parallel without some form of isolation between them, particularly when the batteries are used to power ancillary 12VDC equipment. The danger in this case is that there is no safeguard preventing the load from draining the batteries to a level that exceeds the minimum voltage required to start the vehicle at any given time. Although certain vehicles are factory fitted with a dual parallel battery arrangement, this is specifically to assist cranking (generally for colder climates), not for supplying ancillary equipment fitted to the vehicle.

For this reason it is important to install a master switch between the two batteries to isolate the auxiliary from the main as required.

Historically, manual devices were used to perform this task however over the years various automatic devices such as electronic diode isolators and voltage controlled solenoids have become the norm. An automatic isolator is designed to allow the auxiliary battery to charge from the vehicle's conventional charging system whilst preventing the discharge of the main battery in the event of the auxiliary draining.

This process is controlled by connecting/disconnecting the two batteries at specific voltages determined, in most instances, by the manufacturer of the isolating device and usually for a generic system charging voltage. The problem with these pre-determined voltages is that they do not suit every application as there are many factors to consider, primarily the charging voltage of the vehicle in which they are installed.

From vehicle to vehicle charging voltages vary depending on the manufacturer's electronic management system specification (firmware). As a result some vehicles have the voltage regulated at a lower rate than others. In this instance, a conventional battery isolator with factory pre-set connect/disconnect voltages may not prove suitable as the time the auxiliary battery is combined is limited by the voltage window and may not be enough to enable an effective charge rate.

For example, a common default setting for an automatic isolator is 13.7V to connect and 12.8V to disconnect. It is no coincidence that this is also our default setting for the EBI Pro. In this instance the combine voltage is quite okay if the vehicle's system is regulated at 14.5V because the 13.7V set point is achieved quickly resulting in the auxiliary battery connecting much sooner. If, however, the vehicle's system is regulated at 14.0V, it could take considerably longer for the voltage to reach 13.7V thus reducing the window for the batteries to combine and limiting the auxiliary battery charging time as a consequence.

It therefore makes better sense, in this particular example, to reduce the combine voltage set point to say 13.0V, which will allow the batteries to combine earlier, thus increasing the effective time the auxiliary battery is connected and providing a greater opportunity for charging.

Even if the disconnect voltage remains unchanged at 12.8V and the resulting hysteresis is only 0.2V (in this example), the minimum voltage required to start the vehicle with the main battery is always maintained.

Unfortunately, the option to change the connect/disconnect voltage in standard isolators has only been available via special factory or 'custom' orders which both increases the price and lead time. interVOLT now has a solution in the EBI Pro. The EBI Pro allows the installer/operator to customise the combine and isolate voltages in conjunction with time delay, to suit the vehicle application and usage.

The following pages describe the purpose, installation, set-up and operation of the EBI Pro for use in a typical dual battery arrangement as outlined above.

3. *The vehicle is mobilised. As the engine RPM increases the system voltage increases accordingly to around 14.5V:*
In this state the system voltage has exceeded the programmed set-point of 13.7V. The EBI Pro contacts are closed and the auxiliary battery is now connected to the main battery or in 'COMBINE' mode allowing it to be charged by the vehicle.
4. *The vehicle is driven for a period of time at varying RPM and the system voltage remains consistently above 12.8V:*
In this state the EBI Pro contacts are still closed and the auxiliary battery is constantly connected or in 'COMBINE' mode and being charged by the vehicle.
5. *The vehicle eventually stops and the engine is shut down. The battery currently has a terminal voltage reading of 13.0V:*
In this state the EBI Pro contacts remain closed and the auxiliary battery is still connected or in 'COMBINE' mode.
6. *The vehicle is stationary and the engine is not running. A load, such as a fridge, is connected to the auxiliary battery and the voltage drops to 12.7V after a short period:*
In this state the system voltage has now fallen below the programmed disconnect (minimum) voltage of 12.8V. As a result the EBI Pro contacts are opened and the auxiliary battery is disconnected and in 'ISOLATE' mode. The main battery is now protected from discharging.

Operation

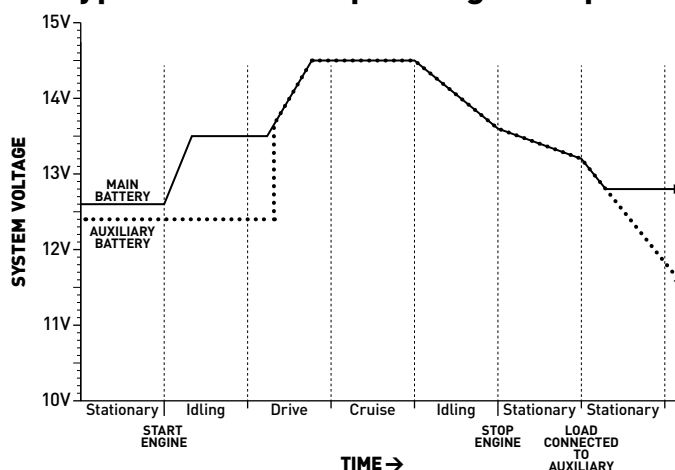
Throughout this manual we will refer to the electronically switched battery circuit of the EBI Pro as 'switch contacts'. This nomenclature is not technically correct as it refers to traditional mechanical or electro-mechanical devices but, for the benefit of simplicity, we will use this terminology.

The EBI Pro is provided with a set of factory default settings which can be changed at any time by the installer/operator. The following synopsis describes the operation of the EBI Pro in a typical scenario and can be read in conjunction with the illustration on page 9. It assumes the factory default settings are unchanged.

In the graph the horizontal axis is representative of 'Time' and the vertical axis of 'Voltage'. The Time line is abstract only and the periods are not scaled in order to clearly depict the function of the EBI Pro. The voltage settings indicated are the factory defaults. For the benefit of clarity, the two batteries have been initialised with a 0.2V difference to separate them distinctly in the graph.

1. *The vehicle is stationary, the engine is not running and the main battery has a voltage reading of 12.6V (design voltage for a 12V battery):*
In this state the auxiliary battery is disconnected from the main battery or in 'ISOLATE' mode as the EBI Pro contacts are open.
2. *The vehicle's engine is started and the system voltage increases to 13.5V as the engine idles:*
In this state the auxiliary battery is still disconnected as the programmed set-point of 13.7V has not yet been reached. The EBI Pro contacts are therefore still open and the EBI Pro remains in 'ISOLATE' mode as a result.

Typical Timeline Operating Example



Voltage

The EBI Pro can be programmed to activate the switch contacts at a desired voltage. An alert voltage can also be set to output a separate signal to trigger a remote visual warning device, an LED light for example. The voltage is sensed by the main battery terminal. The voltage is displayed to one decimal place with an accuracy of $\pm 1\%$. The voltage function, displayed as VOLTS, can be defined as follows:

COMBINE – this is the higher of the two voltage set-points for connecting or combining the two batteries. The switch contacts will be activated (closed) when reaching this voltage set-point. The setting for this trigger is adjustable from 9.2V to 16.0V in 0.1V increments. The factory default setting is 13.7V.

ISOLATE – this is the lower of the two voltage set-points for disconnecting or isolating the two batteries. The switch contacts will be deactivated (opened) when reaching this voltage set-point. The setting for this trigger is adjustable from 9.0V to 15.8V in 0.1V increments. The factory default setting is 12.8V.

ALERT – this is a voltage set-point which outputs to a remote signal device (LED) to indicate any programmed low voltage warning for the auxiliary battery. The indicator (IND) contact will be triggered when reaching this voltage set-point. The setting for this trigger is adjustable from 9.0V to 15.9V in 0.1V increments. The current output for this circuit is limited to 35mA. The factory default setting is 12.0V.

The EBI Pro has a number of special programming features which are detailed on the following pages. In short, these are adjustments which can be performed by the installer or operator and consist of:

- Voltage adjustment – permits the programming of the voltage triggers for the combine, isolate and alert set-points (refer page 11).
- Delay adjustment – permits the programming of the timing triggers for the combine, isolate and alert set-points (refer page 12).

In addition to the programming functions the EBI Pro has a range of other features which provide some very useful benefits to the end user including:

- Emergency combine circuit – this allows the installer to incorporate a remote switch (optional) which can be activated in the event the main battery is drained, to override the EBI Pro and bring in the auxiliary battery for emergency starting.
- Alert status circuit – in conjunction with the alert adjustment function this feature allows remote monitoring via an audible/visual device which indicates low auxiliary battery voltage.
- Automatic overload protection – this sensing circuit identifies excessive overload current or short circuit on the output and shuts down the EBI Pro to prevent damage to the device.
- Automatic thermal protection – this sensing circuit will automatically shut down the EBI Pro in the event the temperature of the device exceeds the safe operating limit.
- LED status display – this feature provides assistance to the installer/operator for various connection, monitoring, control and troubleshooting functions and issues.

Delay

In addition to the programmable voltage set-points outlined in the previous page, timing can also be introduced to prevent threshold switching of the switch contacts. Threshold switching (commonly referred to as chattering in electro-mechanical devices) is the continuous opening and closing of the contacts as the voltage reaches the set-point and fluctuates either side resulting in nuisance switching. The time delay function, displayed as SECS can be defined as follows:

COMBINE – this is the time delay in seconds, between the combine voltage setting being reached and the switch contacts being activated (closed). The setting for this trigger is adjustable from 1-250 seconds in 1 second increments. The factory default setting is 5 seconds.

ISOLATE – this is the time delay in seconds, between the isolate voltage setting being reached and the switch contacts being deactivated (opened). The setting for this trigger is adjustable from 1 -250 seconds in 1 second increments. The factory default setting is 5 seconds.

ALERT – this is the delay in seconds between the actual alarm voltage limit being reached and the indicator (IND) output being triggered. The setting for this trigger is adjustable from 1-250 seconds in 1 second increments. The factory default setting is 10 seconds. The alert time delay is useful to prevent nuisance switching of the alarm when the engine is cranking and the voltage dips momentarily below the alarm set-point, for example.

Counter Charge Control (CCC) Feature

In addition to the conventional operation of the EBI Pro, there is an additional feature provided which allows the EBI Pro to combine under specific conditions. It is not uncommon in 4WD and RV applications to have a solar panel(s) or another form of charger connected to the auxiliary battery when stationary to keep the voltage maintained - whilst camping for example.

Our CCC feature automatically allows the EBI Pro to combine when an auxiliary charging source is connected and the voltage is above a pre-determined limit. Effectively, if a solar panel is connected to the auxiliary battery, providing it exceeds 13.7V and only if the starting battery is less than 12.8V, the EBI Pro will combine and allow the solar panel to charge the main (starting) battery. Whilst the CCC feature is active and the batteries are therefore combined, in the event the system voltage falls below 12.8V the EBI Pro will disconnect the circuit thereby protecting the main (starting) battery from inadvertent discharge.

The CCC function will never interfere with the programmed operation of the EBI Pro. Any time the Emergency Combine Mode switch is activated (for starting) the CCC feature is immediately disabled. It will also be disabled in the event any of the built in protection features of the EBI Pro are activated such as thermal overload, short circuit overload, high voltage on terminals, etc.

In summary, the CCC feature provides a great benefit at absolutely no cost by utilising any excess power generated by the solar charger to charge the main battery but only when it is safe to do so.

Layout

Battery Terminals. These are the two large terminals (studs) which are switching the load, thereby connecting/disconnecting the main and auxiliary batteries. They are line and load sensitive and **MUST** be the same **POSITIVE** polarity. They are fitted with M8 nuts and spring washers. The pin drive nut forms the 'seat' for the main terminal and must NEVER be removed.

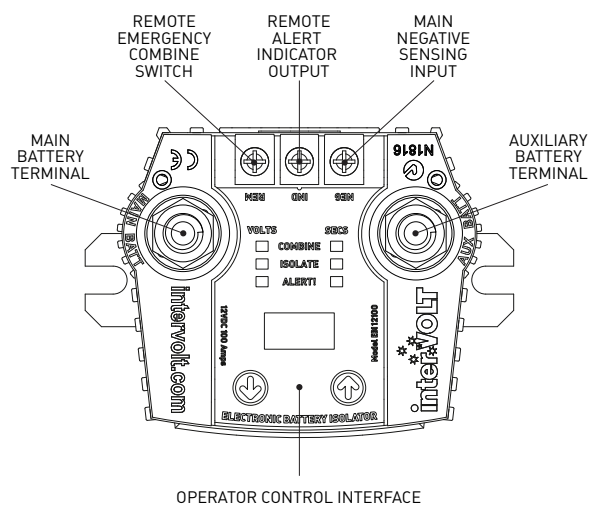
MAIN BATT (main battery) – 12V main or starting battery connection
AUX. BATT (auxiliary battery) – 12V second or auxiliary battery connection

Control Terminals. These are the three small terminals located behind the load terminals. They are fitted with M3 x 6mm cross recessed screws. The terminals are marked as follows:

- NEG (negative)** – 0V input for sensing main negative
- IND (indicator)** – 12V output alert trigger indicator
- REM (remote)** – 12V input for remote emergency combine

NOTE: These terminals must be correctly terminated. An example of the correct method of termination is depicted on page 19.

Operator Interface. The operator interface consists of switches and displays used to control and monitor the EBI Pro functions. The control consists of two buttons marked with up and down arrows. They are used for scroll, adjust and save operations. The 3 digit LED display is used in conjunction with the control buttons to adjust the voltage, delay, state and reset functions of the EBI Pro. These functions are also displayed as text icons and are illuminated when scrolling through the program settings. See over for illustration.



Notice!

The EBI Pro must be properly installed in order to comply with environmental operating considerations and the manufacturer's terms and conditions of warranty. The EBI Pro is constructed from corrosion resistant materials but is not suitable for marine environments. It is not designed or warranted to be used in marine applications. The electronics are enclosed in a sealed housing however it should, wherever possible, be installed in a protected environment. Due to the external termination the EBI Pro is NOT designed to be installed in a location where water can 'short' between the terminals.

LOCATION: Select a suitable location where the EBI Pro can be mounted. Ensure there is adequate ventilation to the heatsink ribs and that the location is free from excessive vibration and heat. Blocking the heatsink ribs will cause thermal shutdown thus reducing performance. The main battery cable should be kept to the minimum practical length in order to reduce voltage drop.

ORIENTATION: The EBI Pro can be mounted in any position vertically or horizontally due to the solid state design. It should be installed on a hard flat surface – do not install on an upholstered or insulated surface. Ensure at least 30mm of clearance all around from any other equipment.

MOUNTING: The EBI Pro should be installed with appropriate fasteners ensuring both anchor holes are utilised. The mounting flange opening diameter is 6mm and it is recommended that a fastener with a diameter (major thread) of no less than 5mm (10 gauge) be used.

Wiring

In order to ensure safety, good performance and long life the EBI Pro should only be wired by a suitably qualified tradesperson in accordance with the instructions below and overleaf. Please refer page 20 for a schematic of the recommended wiring circuit.

IMPORTANT!

Ensure adequately rated cables are used for the maximum load connected to the EBI Pro. If uncertain, consult your cable supplier quoting the continuous rating of the load and the length of cable on both input and output sides of the load terminals. Under-sizing the cable will result in poor performance, over-heating, reduction in longevity and may jeopardise your warranty in the event of a failure.

NOTE: The positive circuit carries the heavy load under charging (and cranking if utilised) and must be wired for high current accordingly. The negative circuit is for voltage sensing (reference) only and is carrying signal current only, maximum 50mA under greatest load.

For complete protection it is necessary to fuse the positive circuit for each battery as close as possible to the terminal (as depicted on page 20). The fusing is not required to protect the EBI Pro, which incorporates automatic overload and short circuit protection but rather, to protect the vehicle in the event a cable rubs through or a terminal inadvertently comes into contact with the vehicle ground for example. The fuse should be rated according to the load and should be no greater than the maximum current rating of the cable being used.

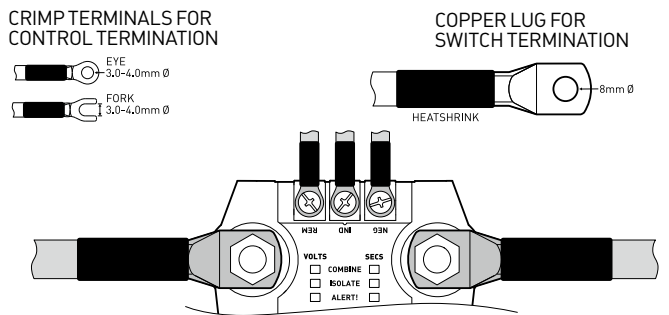
The EBI Pro can be wired for two different functions, charge control only OR charge control with override. It is important to note the differences which are detailed below:

- When used for charge control purposes only the circuit is dealing primarily with the vehicle's electrical system (alternator) as the charging source. The current therefore is limited to the output of the alternator rating, however there are other factors which must be taken into consideration when wiring for this purpose. For example, when the auxiliary battery is drained considerably, the inrush current across the EBI Pro can be considerably higher when the batteries are initially combined. It is therefore very important to size the cable in accordance to both the length of the run and the potential load.
- When used for both charge control and override purposes it is important to factor in a much heavier load. In addition to the charging current, the EBI Pro will also be dealing with the engine cranking current if the main battery is discharged and it becomes necessary to utilise the manual combine function in order to start the vehicle. The current flowing across the EBI Pro could peak at several hundred Amps. Once again, it is very important to size the cable in accordance to both the length of the run and the potential load.

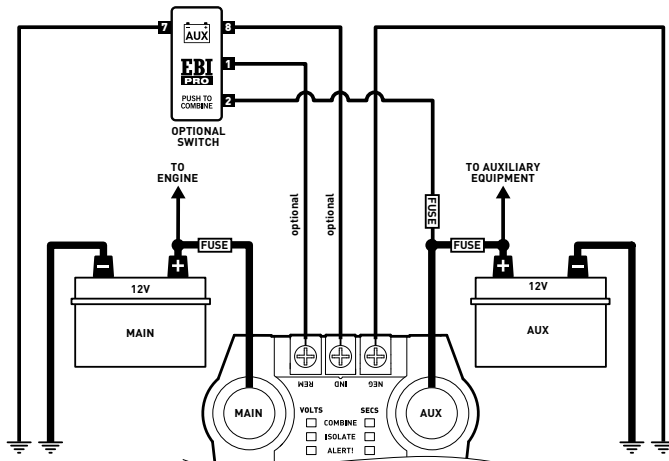
Assuming the auxiliary battery and EBI Pro are now permanently fixed in their correct locations, prewire all the necessary cabling for both main and auxiliary battery positive connections, the negative sensing wire and the optional indicator and remote wiring if required. **DO NOT** connect at this time.

It is recommended that proper tinned drawn-copper cable lugs are used for battery terminal connection. These lugs must be properly crimped using appropriate tooling in order to prevent poor contact which can result in overheating of the stud. An example of the correct method of termination is depicted below.

NOTE: The pin-drive nuts at the base of the battery terminals should NEVER be removed.



Standard Wiring Diagram



Connection

When the terminals are connected in the recommended order, the EBI Pro will indicate on the LED display to confirm the connections are correct. Please follow the steps in order below:

1. Connect the negative sense wire first to the NEG input terminal on the control side of the EBI Pro and the other end to ground (preferably directly to the negative of either battery).
2. If the optional remote combine indicator/switch is fitted, connect the indicator (IND) and remote combine switch (REM) wires to the control side first and the other ends to the indicator/switch ensuring correct polarity (as depicted on page 20). The remote combine switch MUST be a normally open (N/O) momentary device.
3. Connect the pre-prepared auxiliary battery cable to the EBI Pro terminal marked AUX. BATT and the other end of the cable to the auxiliary battery positive terminal. Upon live connection the LED display will indicate **b-2**.
4. Connect the pre-prepared main battery cable to the EBI Pro terminal marked MAIN BATT and the other end of the cable to the main battery positive terminal. This is the cable protected with an inline fuse or circuit breaker. Upon live connection the LED display will indicate **b-1**. With both batteries now correctly connected the display will disappear after a short time.

Functionality

In addition to the programmability of the EBI Pro (covered later in the manual) the device also has several monitoring and control features designed to enhance its operation. Many of these features are diagnostics and are indicated on the LED Status display to assist with troubleshooting. These features are detailed as follows:

Switch Contacts State. When the switch contacts are switched at any time the LED Status display will confirm the state by indicating **On** or **Off** automatically. That is, when the combine voltage set-point is reached and the contacts are closed, the display will indicate **On** for a period of 10 seconds. Conversely, when the isolate voltage set-point is reached and the contacts opened the display will indicate **Off**. Additionally, the state can be manually checked by momentarily pushing either up or down control button at any time. The LED Status display will indicate **On** or **Off** momentarily, depending on the contact state, as it would in automatic mode. The contacts state can also be monitored by the remote alert indicator output. A visual warning indicator such as an LED light connected to the output indicates when the contacts are closed and the batteries are combined. A custom combination switch/indicator code number **EBI12RS** is available for this purpose. See page 26 for details of this special switch function.

Thermal Overload Fault. In the event the device is overheated due to repeated overload/short circuiting or is located in a high temperature environment, the LED display will indicate **Hot** and the switch contacts will be deactivated. The device will continue to retry until the fault is rectified. After cooling sufficiently the device will automatically resume operation.

Circuit Overload Fault. In the event there is an output short circuit or excessive current overload the EBI Pro utilises a clever feature to protect itself from catastrophic failure. This feature does **NOT** substitute the use of fuses which are fitted in the circuit to protect the wiring. The device senses any major or sudden differential in the voltage between the main and auxiliary batteries and disconnects the load terminals instantaneously. In this state the LED display will indicate **O-L** automatically and will remain displayed until such time as the fault is rectified. The display will indicate **O-L** for a further 10 seconds before disappearing. Additionally the device will supply a signal to a visual warning indicator such as an LED dash light connected to the IND output indicating the issue by flashing the light intermittently at a high rate. A custom combination switch/indicator code number **EBI12RS** is available for this purpose. See page 26 for details of this special switch function.

Main Input Fault. In the event the main (starting) battery is unserviceable or there is an open circuit, (a blown fuse or tripped circuit breaker, for example) the LED Status display will indicate **InP** (input) which will remain displayed until the input problem is rectified. In this instance the auxiliary battery must have sufficient voltage in order to power the display. If the auxiliary does not have sufficient voltage the symbols **Lo** or **SYS** may be displayed (refer **System Under Voltage**).

Optional Emergency Combine Switch/Indicator.

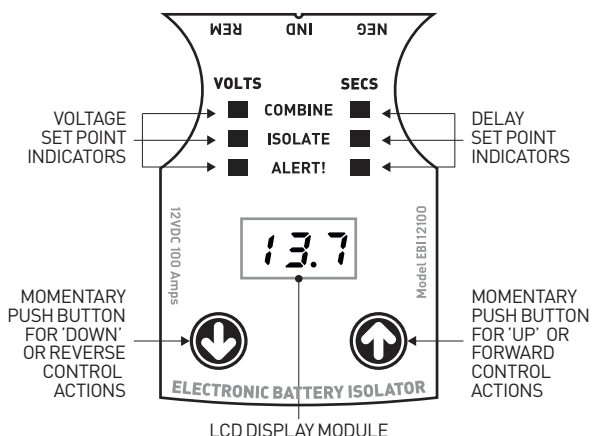
This device is a simple combination momentary rocker switch and LED indicator in one compact package. The device provides a means of both manually engaging the EBI Pro in an emergency (as detailed on the previous page) in addition to visually displaying various ALERT functions.

Manual Combining. In the event the main (starting) battery is depleted, the emergency combine switch can be pressed to engage the auxiliary battery for assisted starting. Once pressed the LED indicator will start a flashing sequence of one short 'blip' followed by a pause in a continuous loop for 10 seconds. This allows time for the inrush current to flow across the EBI Pro's switch contacts allowing the batteries to equalize somewhat before cranking. After 10 seconds the 'blip' will become steady (remain on). Cranking can commence at this point and the device provides a further 10 seconds before switch contacts are disconnected and the LED disappears. If the vehicle fails to start, the process can be repeated by pressing the switch again.

NOTE: Please see safety warning on page 36 regarding use of Emergency Combine Mode.



Operator Control Interface



System Under Voltage. The electronics in the EBI Pro can be powered by either battery (main or auxiliary) depending upon system voltage condition. In a situation where there is insufficient voltage in either battery to power the device safely the EBI Pro will protect itself from failure by shutting down. The power transistors (mosfets) require a minimum voltage to maintain the operation, much like a coil winding in a solenoid needs a minimum voltage to activate (or remain activated).

In the event either or both batteries are low in voltage, the LED Status display will indicate **Lo** and will remain so until the voltage issue is resolved. If the issue is not resolved or in the event of battery failure such as an open cell or when the battery has been drained beyond recovery (effectively dead), the display will indicate **SYS** (system), alerting the issue has escalated to extreme. The **SYS** symbol will remain displayed as long as there is sufficient voltage to power the LED module. When correct system voltage is restored, i.e. charging or replacing the batteries, operation of the device will resume as normal.

System Over Voltage. The electrical system is monitored for high input voltage at all times. In a situation where extra high voltage is sensed on either battery connected to the EBI Pro (due to a faulty battery charger or alternator regulator for example) the device will automatically disconnect the switch contacts to protect either battery. In this state the LED Status display will indicate **Hi** automatically and will remain displayed until such time as the fault is rectified. The display will indicate **Hi** for a further 10 seconds before disappearing.

Remote Alert Indication. The EBI Pro has the additional benefit of a remote alert indication function. A separate terminal (IND) is utilised to output a signal to a remote visual warning indicator, an LED dash light for example. This output is used to monitor various functions and issues as detailed below:

- **Switch Contacts State.** The LED dash light is illuminated when the switch contacts are closed and the batteries are combined. The LED disappears when the batteries again become isolated.
- **Auxiliary Battery Low Voltage.** The auxiliary battery voltage is monitored by the EBI Pro at all times. The ALERT feature of the device is activated when the programmed set-point (or factory default) voltage is reached. The LED dash light indicates the low voltage condition by flashing the light intermittently. Furthermore, the rate of the flash increases in frequency (double rate) once the voltage reduces a further 0.5 Volts below the ALERT set-point.
- **Circuit Overload fault.** In the event the EBI Pro senses a circuit overload the LED dash light indicates the overload condition by flashing the light intermittently at a high rate.
- **Emergency Combine Mode.** If a momentary switch is activated in order to override the EBI Pro (for emergency starting), a timing circuit is activated and a signal is output to the LED dash light. Details of this function are explained overleaf in the manual combining process.

NOTE: A custom combination switch/indicator code number **EBI12RS** is available for this purpose. See page 26 for details of this special switch function.

Set-Up

Once connected and powered the EBI Pro can be programmed if necessary. Keep in mind the factory default settings may already suit your application and there may be no requirement to adjust them. The factory default settings and adjustment range are detailed in the table below:

SETTING	DEFAULT	RANGE
Combine Voltage	13.7 Volts	9.2 - 16.0 Volts
Isolate Voltage	12.8 Volts	9.0 - 15.8 Volts
Alert Voltage	12.0 Volts	9.0 - 15.9 Volts
Combine Delay	5 Seconds	1 - 250 Seconds
Isolate Delay	5 Seconds	1 - 250 Seconds
Alert Delay	10 Seconds	1 - 250 Seconds

Adjustments can be made at any time. Programming is performed by using the scroll buttons in conjunction with the LED Status display and set point indicators. Please take time to familiarise yourself with the Operator Control Interface before attempting any programming. The diagram overleaf depicts the control and monitoring functions.

Press the two control buttons on the operator interface simultaneously. The LED display will indicate a series of scrolling bar segments for a few seconds as it initialises (performing internal system check). Once initialised the display will show the factory default voltage of **13.7**, assuming the defaults have not been changed, and the COMBINE VOLTS indicator will be illuminated (see figure on page 25). If you wish to change the default setting, press the two control buttons again simultaneously and release after the COMBINE VOLTS indicator starts to flash. Once flashing use either the up or down control button to adjust the setting in 0.1V increments to reach the desired set-point. Once selected both buttons can again be pressed to save the setting (if you do not push the two control buttons to save the setting, it will be saved automatically after 10 seconds at which point the display will disappear). The COMBINE VOLTS indicator will stop flashing and remain steady. The new setting has now been saved.

To move through to the next value press either the up or down control button and scroll to the next indicator i.e. COMBINE SECS which will be illuminated. The LED display will concurrently indicate the factory default time setting of **5** seconds. Again, if you wish to change the factory default press the two control buttons on the operator interface simultaneously and the selected icon will begin to flash. Use either the up or down control button to adjust the figure to the desired set-point. Again, press the two buttons simultaneously to save the setting or just leave and it will save automatically after 10 seconds.

These adjustments can be performed for the ISOLATE and ALERT! voltage and time set-points by simply repeating the aforementioned steps.

Although the adjustments can be made at any time, please note that they will not take effect until such time as the pre-existing programmed set-point (voltage or time) has been activated and released. For example if you change the COMBINE voltage from 13.7V to 13.3V and the system voltage is already over 13.3V at the time of adjustment, the new setting will not take effect until the previous set-point has been reached.

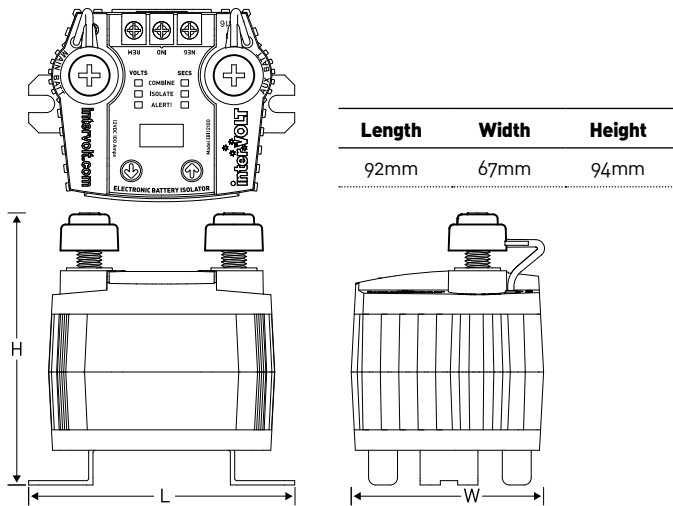
If you wish to reset the factory defaults at any time scroll through the various settings as outlined above until the LED display indicates the **dEF** (default) symbol. Press the two control buttons on the operator interface simultaneously and the **dEF** symbol will change to **YES** (to reset) assuming the factory settings have not been changed. Press the two buttons simultaneously to save the setting or just leave and it will save automatically after 10 seconds. If you do not wish to reset, press either the up or down control button to scroll from the symbol **YES** to **NO**, and repeat the save function.

NOTE: The isolate voltage set-point cannot be set higher than the combine voltage set-point. The smallest differential that can be set between the combine and isolate voltages is 0.2V.

Ref.	Displayed	Status	Page
1	b-1	The main (starting) battery has been connected to the EBI Pro MAIN BATT terminal.	21
2	b-2	The auxiliary (second) battery has been connected to the EBI Pro AUX. terminal.	21
3	On	The contacts are closed and the EBI Pro is in COMBINE state.	22
4	OFF	The contacts are opened and the EBI Pro is in ISOLATE state.	22
5	-On	Emergency Combine Mode has been activated and the EBI Pro is in COMBINE state.	26
6	Lo	The EBI Pro has detected that both batteries are low in voltage.	23
7	Hi	The EBI Pro has detected that either or both batteries are high in voltage.	23
8	SYS	The EBI Pro has detected that both batteries are discharged beyond use.	23
9	InP	The EBI Pro has detected an open circuit (fuse), disconnected input circuit or the main battery is discharged beyond use.	24
10	O-L	The EBI Pro has detected an overload in the circuit and has shutdown.	24
11	Hot	The EBI Pro has shutdown due to high temperature (thermal overload).	22

Design Application	12VDC motor vehicles
Operating Voltage	8 – 17VDC nominal
Continuous Contact Rating	100 Amps @ 60°C ambient
Peak Current Rating	500 Amps for 5 seconds @ 10% duty cycle
Electrical Protection	Thermal overload shutdown – auto reset Electrical overload shutdown – auto reset Under voltage disconnect – auto reconnect Over voltage disconnect – auto reconnect
Device Current Draw	In 'Isolate' mode (open contacts) ↓30mA In 'Combine' mode (closed contacts) ↓40mA Add ≈ 10ma when LED Status Display is active Add up to 30mA for external LED indicator
Contact Resistance	Less than 2 milliohms across the switch terminals
Environmental Protection	IP67 (internal components only).

Operating Temperature	-20°C to +60°C
Operating Humidity	Up to 98%, non-condensing
Indicator Output	+12VDC (maximum 30mA)
Remote Input	+12VDC
Enclosure Housing	Heatsink – E-Coated A360 die cast aluminium Lid and Base – Electrical grade polycarbonate Mounting Bracket – Bright zinc plated steel Terminal Protector Boots – NBR rubber
Contact Terminals	Tin plated copper, stainless steel hardware
Control Terminals	Tin plated brass, stainless steel hardware
Dimensions	Footprint – 62mm x 92mm including bracket Profile – 94mm including terminal boots
Weight	495 Grams



Important Safety Warning

USING EMERGENCY COMBINE MODE

As detailed on page 26, Emergency Combine Mode is utilised to start the vehicle in the event the starting battery has been inadvertently drained.

In Emergency Combine Mode the operator is effectively overriding the programmed settings in addition to specific protection features in order to start the vehicle in a critical situation. It is important to note therefore, that the Emergency Combine Mode cannot be used to support a main battery that has simply expired (end-of-life). If it is suspected the battery has expired or it is visibly damaged it will be necessary to physically 'swap out' the main battery with the auxiliary rather than attempting to connect the batteries via the EBI Pro.

Furthermore, it is important to investigate the reason for the main battery failure before attempting to utilise the Emergency Combine Mode. For example, the battery may have suffered mechanical damage, separator failure or electrolyte loss, wiring may have come adrift or there may be a vehicle electrical system fault. Regardless, there are innumerable reasons for battery and/or system failure and it is important to investigate this prior to engaging the Emergency Combine Mode switch.

Using the Emergency Combine mode in the instance outlined above can result in overheating of the main battery and/or cabling and subsequent fire risk if not correctly fused. It may also result in irrevocable damage to the EBI Pro.

FUNCTION	SETTING	FUNCTION	SETTING
Combine Voltage		Combine Delay	
Isolate Voltage		Isolate Delay	
Alert Voltage		Alert Delay	

FUNCTION	SETTING	FUNCTION	SETTING
Combine Voltage		Combine Delay	
Isolate Voltage		Isolate Delay	
Alert Voltage		Alert Delay	

FUNCTION	SETTING	FUNCTION	SETTING
Combine Voltage		Combine Delay	
Isolate Voltage		Isolate Delay	
Alert Voltage		Alert Delay	

interVOLT products are warranted for a period of 24 months against faulty materials and/or workmanship from date of purchase by the end user subject to proof of purchase. In the event proof of purchase is not provided, and at the discretion of the manufacturer, the warranty shall be 24 months from manufacturer's date of sale to the merchant from whom the product was purchased. interVOLT's 24 month warranty is subject to the following terms and conditions.

The goods must be installed and operated in accordance with the manufacturer's recommendations and instructions set out within this booklet.

In the event of a claim the goods are to be returned to the original point of purchase with a copy of the merchant invoice or the relevant merchant invoice number.

In the event of a claim any associated expenses including diagnosis, removal, and/or installation of the goods is the responsibility of the client including any freight costs.

The warranty shall be void where the goods have been used for a purpose for which they are not intended, or altered in any way that is detrimental, or opened or tampered with by an unauthorised party, or damaged by mechanical abuse, or contaminated by water or other substances, or damaged by incorrect application.

Save and except for the express warranty set out above and to the maximum extent permitted by law, all conditions and warranties which may at any time be implied by the common law, Trade Practices Act, Fair Trading Act or any other State or Federal Act are excluded. To the extent that these cannot be excluded and where the law permits, the manufacturer in respect of any such condition or warranty shall be limited at their option to the repair or the replacement of the goods or the supply of equivalent goods or refunding the cost of the goods.