



x2

Twin DBW Throttle Controller - Dual Mode Version

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TRPx2 Safety Features

Reverse battery hookup protection to prevent damage to the unit.

Controller reboot if data processing stalls for more than 8 millisecond.

Fault detection by both primary and supervisory MCUs. These include TPS signal rationality evaluation and monitoring desired vs actual throttle position, current limitation, and monitoring the health of the motor driver.

Any faults will trigger shutdown of the secondary throttle body and trigger a fault in the factory throttle control system so that both throttle bodies are disabled.

If the primary MCU fails or does not detect a fault, the supervisory MCU will send a throttle shutdown message to the primary MCU and cut power to the throttle motor.

The supervisory MCU must be functional in order for the throttle motor to be enabled.

Shutdown of the primary throttle body by the factory ECM will put the x2 in standby mode, so that both throttle bodies are disabled. The x2 uses 2 different methods to detect this.

Factory failsafes such as TP vs Airflow or TP vs RPM remain active in the event of a stuck_throttle condition so that the ECM can take appropriate action.

Installation

Select a suitable mounting location for the control unit where it will not be subjected to high temperatures.

1. Cut the long Black wire from the unit to length and connect to a clean, secure ground source.

2. Cut the long Red wire from the unit to the required length and connect it to the ETC power circuit from the vehicle power distribution center. This will ensure that both the OE and **x2** throttle controls power up/down simultaneously. A 15 AMP fuse should be used to protect the circuit. Alternatively, a fuse tap may be used and inserted into the ETC fuse slot. If no ETC fuse is shown, find a fuse that provides 12V to the vehicle ECU under control of the Powertrain Control Relay. For example, Pin 47 of the x1 connector on a GM E38 ECU is such a circuit.

3. Connect all remaining mandatory circuits as per x2 main connector application specific(twin throttle or bypass actuator) pinout sheet. All original throttle wiring should remain intact.

a) Analog throttle sensor systems:

The 4 wires marked “splice to primary” should be connected to that wiring as indicated....Green to TPS1, Purple to TPS2, White to signal ground/Low reference, and Yellow to TAC Motor Control 1(opening rotation). There are 6 wires for the secondary throttle body.

Join the Purple and Pink wires in order for the x2 to be able to trigger Reduced Engine Power mode in the primary throttle system if it detects any fault.

b) Digital throttle sensor systems(single TPS signal wire)

The green and purple wire of the “splice to primary” group are not used. Connect the White to signal ground/Low reference, and Yellow to TAC Motor Control 1(opening rotation) of the factory throttle wiring. Connect the Light Green wire marked “Primary TPS Digital” to the TPS signal wire of the factory throttle wiring.

Similarly, the green and purple wires of the “secondary throttle” group are not used. Connect the Light Green wire marked “Secondary TPS Digital” to the secondary throttle TPS output.

Connect the Pink wire to one of the factory pedal position sensor wires(e.g. PPS2) in order for the x2 to be able to trigger Reduced Engine Power mode in the primary throttle system if it detects any fault.

4. In throttle control applications, optionally, the blue wire can be used to temporarily place the controller in standby mode. The secondary throttle will be disabled while this circuit is grounded.

Never connect this wire to a +12V source. The throttle blade will be at the spring-determined position, which is approximately 20% rotation for GM throttle bodies.

c) LT5 supercharger bypass actuator

Connect the purple wire at 3A to a 0-5V trigger source or, if using a digital TPS signal as the trigger, connect the light green wire at 3C to the digital throttle signal wire. In that case 3A(purple) and 3B(dark green) become unavailable as spare inputs and should remain not connected to anything.

Connect the yellow wire at 2C to a 0-5V secondary trigger source if desired.

Connect the White(2B) to signal ground/Low reference of the trigger sensor.

Connect the Blue wire(1B) to a switch wired to ground to enable/disable Boost Reduction.

1D, 1E, 2D, 2E, 2F should be connected to the LT5 bypass actuator via the appropriate connector.

Calibration

Twin Throttle:

1. Turn the key to the on position. If the **x2** has not yet been calibrated after a reflash, or if a prior calibration procedure was incomplete, both the yellow and green LEDs will be flashing simultaneously and slowly, and Reduced Engine Power mode may be triggered. Wait approximately 30 seconds until the throttle body connected to the OE control circuit becomes inactive. At this point you should be able to move the blade freely by hand.
2. Calibration mode can be initiated at any time, even if the controller has been previously calibrated. To enter calibration mode, press and hold the Green LED and Red LED switches on the **x2**, release the red LED switch first, then the green LED switch 2 seconds later. Do not touch the throttle bodies. The red LED will light for a few seconds, then the green and yellow LEDs will flash alternately at a fast rate and the red LED slowly for about 12 seconds
3. **While the LEDs are flashing**, calibrate the **primary** throttle body: Move the throttle blade **by hand** to the fully closed and fully open positions in any order. Hold it tight at each position for 1-2 seconds. Once the 12 sec primary throttle calibration period ends the secondary throttle body will self-calibrate....**Keep your hands clear!**

Calibration is complete when the green and yellow LEDs are on solid and the red LED stays off.

4. Turn off the ignition for 30 seconds to reset the vehicle ECM and the x2.

The green LED will be flashing while the x2 is active. If the primary throttle body remains in the parked position for at least 6 seconds, the secondary throttle body will power down and the yellow LED will be flashing. For some PCMs (e.g. GM 411) which completely deactivate the throttle motor after a few seconds, the yellow LED will be on solid. As soon as the primary throttle body is active and leaves the parked position, the secondary throttle body will re-activate.

LT5 Bypass Control:

Turn the key to the on position to power up the unit. If the unit has not been previously calibrated, or new firmware has been loaded, the green and yellow LEDs will be flashing alternately indicating that the unit is ready to be calibrated. Calibration mode can also be initialized by holding the green LED switch while pressing and releasing the red LED reset switch, then releasing the green LED switch 2 seconds later.

Set the trigger input to the desired value and hold it there while pressing the green LED switch for 3 seconds, then releasing the switch. For example, the trigger may be a given throttle % if the trigger input is wired to the throttle position sensor. Or, if emulating a vacuum actuated bypass valve, it can be a voltage signal from the inlet MAP sensor which corresponds to a given inlet vacuum. This initial trigger value is not critical as it can be set to any desired value via the **x2** PC app. The **x2** also learns the ranges of the bypass actuator position sensors during calibration. Wait until all LEDs stop flashing and only the green and yellow LEDs are illuminated. Bypass actuator control will be active after the unit is power cycled once, or after the reset switch is pressed and released. The trigger voltage value, ramp in range, as well as the minimum bypass valve opening can be adjusted with the **x2** PC app.

See the [x2 PC app documentation](#) for the additional settings.

Not all LED status indicators apply to LT5 bypass actuator control mode.

LED Status Indicators

After calibration, the red LED will be on solid for several seconds any time the **x2** detects a fault condition during normal operation. In throttle control applications, this will trigger Reduced Engine Power (REP) mode in the vehicle ECM and both throttle systems will shut down with the blades returning to the parked position. Afterward, depending on which MCU first detected a fault condition, one or two LEDs will be flashing as per the following chart.

Red/Yellow LED	Condition
1 blink	Primary throttle Input signal out of range/short/disconnect > REP will be triggered
2 blinks	Secondary throttle Input signal out of range/short/disconnect > REP
3 blinks	Primary throttle TPS1 to Secondary throttle TPS1 out of sync > REP
4 blinks	Overcurrent condition or inadequate/disconnected system ground > REP
5 blinks	Motor Driver Fault > REP
6 blinks	Secondary throttle TPS1 to TPS2 disagreement > REP
Green LED	Condition
Blinking rapidly**	Secondary throttle active
Blinking slowly**	Both throttles in standby or redundant fault detection system has triggered REP if Red LED is active (double flashes).
On solid for 1 second every 2-3 seconds	Indicates that redundant fault detection system is functioning. ** This is superimposed on the throttle active/standby blinks.
On Solid	Controller in Standby mode by optional standby switch or supervisory has detected a fault(red LED will be flashing)
Red LED	Condition
Blinking slowly	Supervisory MCU not calibrated - perform calibration
On solid	Supervisory in standby
Yellow LED	Condition
On Solid	Secondary throttle in standby, ECM/PCM has cut all power to primary throttle actuator (e.g. GM 411 PCM with key on/engine off) or REP has

	been triggered by factory ECM/PCM
Flashing rapidly	Secondary in standby, Primary has not moved from parked/neutral position for more than 6 seconds.

Fault codes are stored in the **x2** for 4 key-on cycles. The last codes stored may be retrieved via the x2 Controller PC application or by pressing the yellow LED switch for 3 seconds. Pressing the switch will trigger REP if any stored faults exist. The red and/or yellow LEDs will then be flashing as per the preceding chart.

The controller fault memory can be cleared by pressing the red LED/reset switch 5 times while powered up.

Unless an actual fault condition is still present, vehicle ECM REP mode can be reset by turning the key off for at least 30 seconds.

Throttle Control Tuning Considerations

The throttle area scalar will need to be adjusted in the vehicle calibration.

Throttle response tables may need to be modified (decreased) to prevent an overly responsive throttle at pedal positions where less than full out performance is desired.

Review any tables that reference throttle position.

Expected airflow tables will have to be increased as necessary while still being within reason as an additional fail-safe mechanism should a stuck throttle condition occur. ****DO NOT SIMPLY MAXIMIZE THESE TABLES****

Firmware Updates

If available, firmware updates may be installed to the **x2** by the following procedure.

1. Download and install the x2 software for Windows from [Downloads](#) .
2. Download and save the latest firmware files from the same link or which have been sent to you via email.
3. Open the x2 Controller application, click the software update tab and select the the appropriate firmware files; x2_main.trp for the main controller and x2_super.trp for the supervisory controller.
4. Remove the rubber plug from the **x2** enclosure and connect the **x2** to your computer using an appropriate USB cable (A-B). Follow the instructions given in the x2 application.
5. Re-Calibrate the **x2**.

****Note:** Updating will not proceed if the position of the green LED/calibration switch while connecting the USB cable does not match the selected update file (main vs super). For units manufactured prior to October 2019, the green switch must be held until flashing the primary MCU is complete at 100%.

The x2 Controller application may also be used for customizing the operation of the controller, reading stored fault codes, diagnostics and troubleshooting. Please refer to the x2 PC Application documentation.

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