VEI Systems Installation Instructions
Ford Mustang SN-95 Multi-Function Clock-Housing Gauge (CHG)

Applicable model numbers:	SN95CHG-E85-R	Ethanol-gasoline content ratio
	SN95CHG-IAF-R	Intake air temperature
	SN95CHG-OPP-R	Oil pressure
	SN95CHG-OTF-R	Oil temperature
	SN95CHG-BHP-R	Hi-res vacuum-boost
	SN95CHG-VOM-R	Voltmeter
	SN95CHG-WTF-R	Water/coolant temperature
	SN95CHG-WBA-R	Wideband air-fuel ratio
	SN95CHG-7M0-R	7-function + clock (no sensors)
	SN95CHG-7M1-R	7-function + clock (with sensors)

Please read these instructions completely before beginning installation to ensure that you have the tools and skills necessary for installation and operation of this instrument. If you are not sure that you can perform the installation safely, then consult a qualified installer. Further instructions available at www.VEISystems.com/technical.html .

FEATURES
This SN95 clock-housing gauge (CHG) is a multi-function gauge module for Ford Mustangs from 1994-1998 that has a dash clock, and can be retrofitted on some cars that did not come with the dash clock, even on new-edge Mustangs.

The CHG can monitor one or more engine parameters, depending on the specific model. The single-function version is available with any of the following functions: ethanol-gasoline ratio, intake air temperature, oil pressure, oil temperature, hi-res vacuum-boost, voltmeter, water-coolant temperature, wideband air-fuel ratio. Each of these comes with the matching sensors, except for the voltmeter (as no sensor is required), and the wideband air-fuel ratio which is compatible with any third-party sensor/controller that has a 0-5V analog output. All of these come with a clock feature so that that function is not lost.

The multi-function versions are available with or without all the required sensors (except voltmeter and wideband air-fuel ratio as above). The expectation of the no-sensor version is that you can add sensors individually over time depending on your needs.

On these gauges, tapping the clock button or an optional external button allows cycling through the various parameters being measured.

MOUNTING

Before starting assembly, gather some necessary items such as screwdrivers, cutters, crimpers, wires, terminals, etc. As there are several variations of wiring harnesses in vehicles that this gauge can be used in, and because they're commonly available items, we do not provide the hook-up wires or terminals to connect to specific vehicles. You can use basic 18 AWG to 22-AWG hookup wire from an auto-store. An ESD/anti-static wrist strap is provided to protect the electronics during installation.

Removal/disassembly:
- Remove the clock pod from top of dash, by unsnapping the 3 clips,
- Unplug the electrical connector from the clock module inside the pod,
- Remove the 2 screws holding the clock module to the inside of the pod,
- Open the clock module, by lifting the tabs on the sides,
- Carefully remove the two electronic PCBs (printed-circuit boards) from inside the clock module. Note that they are attached to each other. There are some tabs holding the back PCB in the module housing. The switches should stay in place in side the clock module.
- You will not be using the stock gauge PCB or plug/harness anymore.

Installation/assembly:
- Insert the CHG electronics PCB module in the clock housing. With the PCB seated properly, check that the outer "M" switch has a nice click feel/sound when pressed.
- Plug in the wire connectors into the CHG PCB. All connectors have different numbers of pins so each only fits a specific connector on the board, and all are keyed so they only fit one way.
- Route the wires through any of the holes in the back cover of the module.
- Snap the module cover back on. The PCB should be snug between the two covers of the module.
- Re-mount the electronics module in the pod with the original 2 screws.
- Continue to the wiring section below, then you can snap the pod back into place on the dash.

Sensors:

The sensors you will need to install will depend on which CHG version you have. Use ONLY the sensor model numbers listed as other sensors will most likely have different calibrations and may damage the gauge. Follow only the applicable sections below.

- SEN-FF1 (Ethanol-gasoline content ratio): Mount the sensor on the inner fender or firewall where it's easy to route fuel lines. Route the fuel lines through the sensor using quick-disconnect fittings. These are available with barbed or AN ends. You should generally route the sensor on the return side of the fuel rail.

- SEN-IAT2E (Intake air temperature sensor): Mount the sender in the intake-air stream, usually near the throttle body, or mass-air sensor, or in the inlet or outlet of an intercooler. The sensor has 3/8"-NPT threads, so the mounting location can be drilled and tapped, or a 3/8"- NPT bung can be welded at the appropriate location.

- SEN-P101C (Oil temp to 100 PSI): This sensor has 1/8"-27 male NPT threads. Mount the sender onto the oil or fuel system port in a location that is not subject to excessive heat, such a near exhaust headers. Remote-mount hoses or extensions may be used to avoid high-heat locations or for better clearance, but braided lines are preferred and ensure that it's rated for the expected pressure.

- SEN-T320D (Oil temperature): Mount the sender on the engine block at an appropriate location (generally be where there was an existing oil-temperature switch or sender). You can tee off the existing sender or switch if you need to keep both. If you are unsure of a suitable location, consult the vehicle service manual or a qualified installer for. CAUTION: teflon tape or compound may eventually break off and get into the oil stream, causing blockage in the oil passages and cause engine damage. If you experience leaks, try tape only on the back half of the threads on the sender. The engine must be well grounded to the chassis & battery. If using teflon tape, measure the resistance between the outer body of the temperature sender and the engine block to ensure good electrical contact.

- SEN-P70B (hi-res vacuum-boost): Mount the sender behind the dash (preferred) or on a relatively cool part of the engine bay, such as in the ECU-box, behind a secondary firewall (if the vehicle has one) or behind a fenderwell. Make sure it will not come in contact with water or other fluids. Secure it to the mounting location with 2 screws (#6, #8 or M5) or attach with adhesive tape or velcro.

- SEN-T320D (Water/coolant temperature): Mount the sender on the engine block in an appropriate location (generally be where there was an existing water-temperature switch or sender). You can tee off the existing sender or switch if you need to keep both. CAUTION: teflon tape or compound may eventually break off and get into the water stream, causing blockage in the water passages and thus cause overheating. If you experience leaks, try tape only on the back half of the threads on the sender. The engine must be well grounded to the chassis & battery. If using teflon tape, measure the resistance between the outer body of the temperature sender and the engine block to ensure good electrical contact.

- NOTE: no sensor is required for the voltmeter.

- NOTE: for wideband air-fuel ratio, use any third-party wideband oxygen sensor with controller that has a 0-5V linear output. Some controllers with a 0.5V – 4.5V output such as AEM's inline units will work as well. For those, project the output "line" to 0V and 5V and use those values for Ya and Yb respectively on the gauge configuration (explained below). Mount the sensor and controller as per that product's installation instructions.
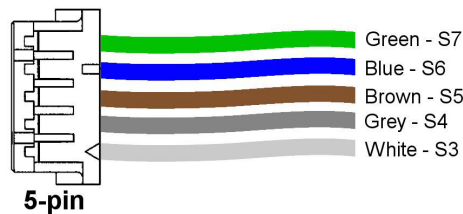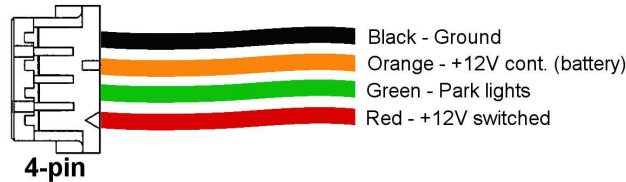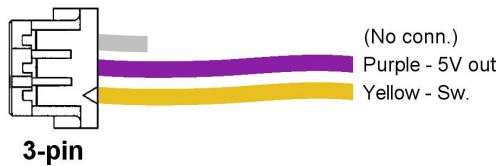
WIRING

The wires should be connected as below using crimp-on butt-splice connectors, or soldered and sealed with heat-shrink tubing. Before connecting any wires, you should either disconnect the battery power, or carefully connect the wires in the order shown. If not, you may damage the instrument. Use an existing fuse in the fuse panel, or an external fuse to supply power to the instrument. This gauge uses less than 100mA of current so a 1/4-Amp fuse is fine.

CHG module:

Connect the wires as listed here. All wires may not be needed depending on the model you have. Be careful not to confuse the wires are there may be two of the same color wires, but they'll be on different connectors. Also, ensure there's no tension on any of the wires.

The following diagram shows the wires for the full-function version of the CHG. If you have a single-function CHG, you will only have some of these wires.

2-pin

Grey - S2
White - S1

3-pin

(No conn.)
Purple - 5V out
Yellow - Sw.

4-pin

Black - Ground
Orange - +12V cont. (battery)
Green - Park lights
Red - +12V switched

5-pin

Green - S7
Blue - S6
Brown - S5
Grey - S4
White - S3

4-Pin connector/plug:

- BLACK – connect to a solid chassis ground under the dash, or directly to the battery. You may need to expose the metal connection point under the dash by scraping or lightly sanding it. A ring terminal and a screw should work well in most cases.

- RED – connect this to a source of **switched** +12V power. This will usually be found at or near the ignition switch, and will usually have a relay wired through the ignition switch. An alternate source of this is a switched power line from a nearby light or accessory (radio, etc). If you are unsure that the wire can support the power required for the instrument, then use an external relay.

- ORANGE – connect this to the positive battery terminal. Note that this connection will always have +12V, even if the ignition key is off.

- GREEN – connect this wire to the positive line (+12V) from the headlight switch. When this line receives a positive voltage, the gauge will use the "park-lights" brightness setting. You may on older vehicles connect this wire to the interior dash lights that come on when the park lights are switched on, however on newer vehicles the lights may be PWM dimmer (oscillating on and off rapidly to control brightness), so the gauge may flicker. Alternatively, if setting up a racing-mode display, this can be connected to a separate mode switch (12V or 0V signal).

2-Pin connector/plug:

- WHITE (S1) – for the E85 gauge, this is the input wire for the sensor. Connect it to the white wire on the SEN-FF1 flex-fuel sensor. For the single-function oil-temperature CHG or the full-function CHG, this is the sensor input for the oil-temperature sensor. Connect this wire to the tip of the SEN-T320D oil temperature sensor.

- GREY (S2) – this is the signal input wire for the vacuum-boost sensor, if your CHG has this function. Connect it to the white wire on the SEN-P70B vacuum-boost sensor.

3-Pin connector/plug:

- YELLOW – this wire is for an optional external switch. If you use this feature, connect this wire to one end of a momentary push-button switch (N.O. or Normally Open). Connect the other end of the switch to ground. If you don't use this feature, tape this wire up by itself so it does not accidentally connect to anything else.

- PURPLE – this wire supplies +5V for the vacuum-boost sensor and for the active oil-pressure sensors. Connect this to the purple wire on theP70B and/or P101C sensors as appropriate, depending on the CHG version you have.

5-Pin connector/plug:
- WHITE (S3) – this is the sensor input for the water-temperature sensor. Connect this wire to the tip of the SEN-T320D water/coolant temperature sensor.

- GREY (S4) – this is the sensor input for the oil-pressure sensor. Connect this wire to the white wire of the SEN-P101C oil pressure sensor.

- BROWN (S5) – this is the signal input for the wideband air-fuel ratio controller. Connect this wire to the 0-5V analog output of the wideband air-fuel ratio controller.

- BLUE (S6) – this is the sensor input for the intake air temperature sensor. Connect this wire to the yellow wire of the SEN-IAT2E intake air temperature sensor.

- GREEN (S7) – this is the signal input for the voltmeter. Connect it to the battery positive or +12v switched input, or to any other point at which you wish to measure the voltage.

SEN-FF1 Ethanol-gasoline content ratio sensor:

o BLACK -- connect to ground at the same point that the gauge is grounded.

o RED -- connect this to +12V (switched, so it turns off when the ignition key is off). This can be the same point as the gauge.

o WHITE– this is the output signal of the sensor. Connect this to the white wire on the 2-pin connector on the CHG (S1).

SEN-T320D Oil temperature sensor:

o Use a #10 ring terminal and crimp one end of a wire to it. Secure that terminal to the stud at the top of the sensor. You can remove the top nut to insert the terminal then re-mount the nut to secure the terminal. Note that the body of the sensor becomes an electrical contact to ground, so ensure that connection and ground path (through the engine, ground strap, chassis, to battery negative is all proper. If you have a multimeter, measure the resistance between the sensor body and engine block to ensure the connection is good. Connect the other end of they wire to the white wire on the 2-pin connector on the CHG (S1).

SEN-P70B Vacuum-boost pressure sensor:

o BLACK -- connect to a solid chassis ground under the hood, or directly to the battery. Ideally, connect it to the same ground point as the gauge. You may need to expose the metal connection point under the hood by scraping or lightly sanding it. A ring terminal and a screw should work well in most cases.

o PURPLE -- connect this to the purple wire on the gauge (which supplies +5V to this sensor). DO NOT connect this to +12V as this will damage the sensor.

o WHITE – this is the output signal of the sensor. Connect it to the grey wire on the 2-pin connector on the CHG (S2).

SEN-T320D Water temperature sensor:

o Use a #10 ring terminal and crimp one end of a wire to it. Secure that terminal to the stud at the top of the sensor. You can remove the top nut to insert the terminal then re-mount the nut to secure the terminal. Note that the body of the sensor becomes an electrical contact to ground, so ensure that connection and ground path (through the engine, ground strap, chassis, to battery negative is all proper. If you have a multimeter, measure the resistance between the sensor body and engine block to ensure the connection is good. Connect the other end of they wire to the white wire on the 5-pin connector on the CHG (S3).

SEN-P101C Oil pressure sensor:

o BLACK -- connect to ground at the same point that the gauge is grounded.

o PURPLE -- connect this to the purple wire on the gauge (which supplies +5V to this sensor). DO NOT connect this to +12V as this will damage the sensor.

o WHITE– this is the output signal of the sensor. Connect it to the grey wire on the 5-pin connector on the CHG (S4).

Wideband sensor and air-fuel ratio controller:

o   Wire up the wideband sensor/controller as per that manufacturer's instructions. Note the wire that has the 0-5V analog output signal as that will be the signal to the gauge input. Connect that wire to the brown wire on the 5-pin connector on the CHG (S5).

SEN-IAT2E Intake air temperature sensor:

o   BLACK -- connect to ground at the same point that the gauge is grounded.

o   YELLOW -- connect this to the blue wire on the 5-pin connector on the CHG (S6).

Voltmeter:

o   The voltmeter does not require a sensor. The green wire on the 5-pin connector (S7) is the sense wire for the voltmeter, and can be connected to the the same point as the red +12V switched power wire (on the 4-pin connector), or it can be used as a true P.O.L. voltmeter by connecting it to any point to be measured, such as directly to the battery positive.

OPERATION

When the gauge is first powered up, you'll be in normal operation mode, showing a parameter on the gauge. Press and hold the button for a few seconds to change the mode. Press and release quickly (tap the button) to change the setting in any mode. Modes are as follows:

MODE	DISPLAY	SETTINGS
Normal	(Value)	Shows the value of the current parameter selected. Tap the button to change the displayed parameter. The title of the newly-selected parameter will be flashed quickly before showing the value.
Start	(function)	Allows you to select which function will be shown on the display each time the ignition key is cycled to the On position. "LAST" will show the last function that was selected when the gauge was powered off.
Time format	12h / 24h	Changes the time format to either 12-hour or 24-hour mode.
Set time hours	12.--	Set the hours for the clock.
Set time minutes	-.00	Set the minutes for the clock.
Daytime brightness	br.9	Set the brightness for the day time (park lights off)
Nighttime brightness	bL.1	Set the brightness for the night time (park lights on)
Set configuration mode	CF.Of	Set the configuration mode on or off. When this is set to "On", cycling power to the CHG off and back on will put the gauge into configuration mode, where the wideband air-fuel settings can be changed. Power-cycling again will put the gauge back into normal mode.
Set calibration mode	CA.Of	Set the calibration mode on or off. When this is set to "On", cycling power to the CHG off and back on will put the gauge into ambient calibration mode, which will perform the calibration automatically and return the gauge to normal mode.

Configuration modes:

When in the configuration mode section, these will be the modes available. Cycle power off and back on to get the gauge back into normal mode.

MODE	DISPLAY	SETTINGS
Ya	YA / 1.00	Shows the air-fuel ratio value represented by 0V from the wideband controller. This must be set/matched to the same value as the wideband controller. If the wideband controller specifies a range from 0.5 to 4.5 volts, you can extrapolate the air-fuel value back to 0V to get this value.
Yb	Yb / 5.00	Shows the air-fuel ratio value represented by 5V from the wideband controller. This must be set/matched to the same value as the wideband controller. If the wideband controller specifies a range from 0.5 to 4.5 volts, you can extrapolate the air-fuel value up to 5V to get this value.
Range	Rng. / 9.99	Changes the time format to either 12-hour or 24-hour mode.
Set filter/damping rate	Filt. / 1	Set the damping (response) rate for the wideband air-fuel function.

Calibration mode:

When the calibration mode is set to on, cycling power to the gauge will automatically activate the ambient pressure calibration. This is necessary to set the reference ambient pressure for the area you're in, and should be done if you move to an area with a different ambient pressure. This feature greatly increases the accuracy of the vacuum-boost function.

It this mode, you will see "P.Cal", followed by a series of sequencing dots, then the gauge will go to normal operation. This process takes less than 5 seconds.

WARRANTY & LIABILITY
Neither VEI Systems, nor its dealers or agents shall be liable in any way, for any damage, loss, injury or other claims, resulting from the installation or use of this product. By purchasing or installing this product, you assume all liability of any kind connected with the use and/or application of this product. If you are unsure that you can safely install and use this product, consult a qualified installer or mechanic.   The warranty on this product covers only the product itself for a period of 1 year from the date of purchase, and it will be at our discretion to repair or replace the affected parts. No user serviceable parts inside. Warranty void if product enclosure opened.