

NetGain Motors, Inc.

800 South State Street / Suite 4 / Lockport, IL 60441 / 630-243-9100 / 630-685-4054 (FAX)

User Manual

Dana TM4 Compact Display



NetGain Motors, Inc.

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Compact Display Capabilities

The SME Compact Display is an optional add-on component for any **HyPer-Drive X1** or **HyPer-Drive X144** controller/Inverter. The immediate EV capabilities of the Compact Display include:

- Display vehicle speed in MPH or KM/H. This is a calculated value determined by tire diameter and up to two gear ratios.
- Display active fault code of highest priority.
- Indicate main battery pack state of charge.
- Indicate de-rating due to Motor or Inverter over-temperature.
- Cycle between 3 operating profiles with push button (E/S/H) switch. Must be [assigned](#) in clone file.
- **Not available in 2BD Firmware:** View parameter values and states in “Diagnostic Mode”. Pressing ENTER and DOWN keys together for 2 seconds will enter the display’s Diagnostic mode.

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Compact Display Specifications

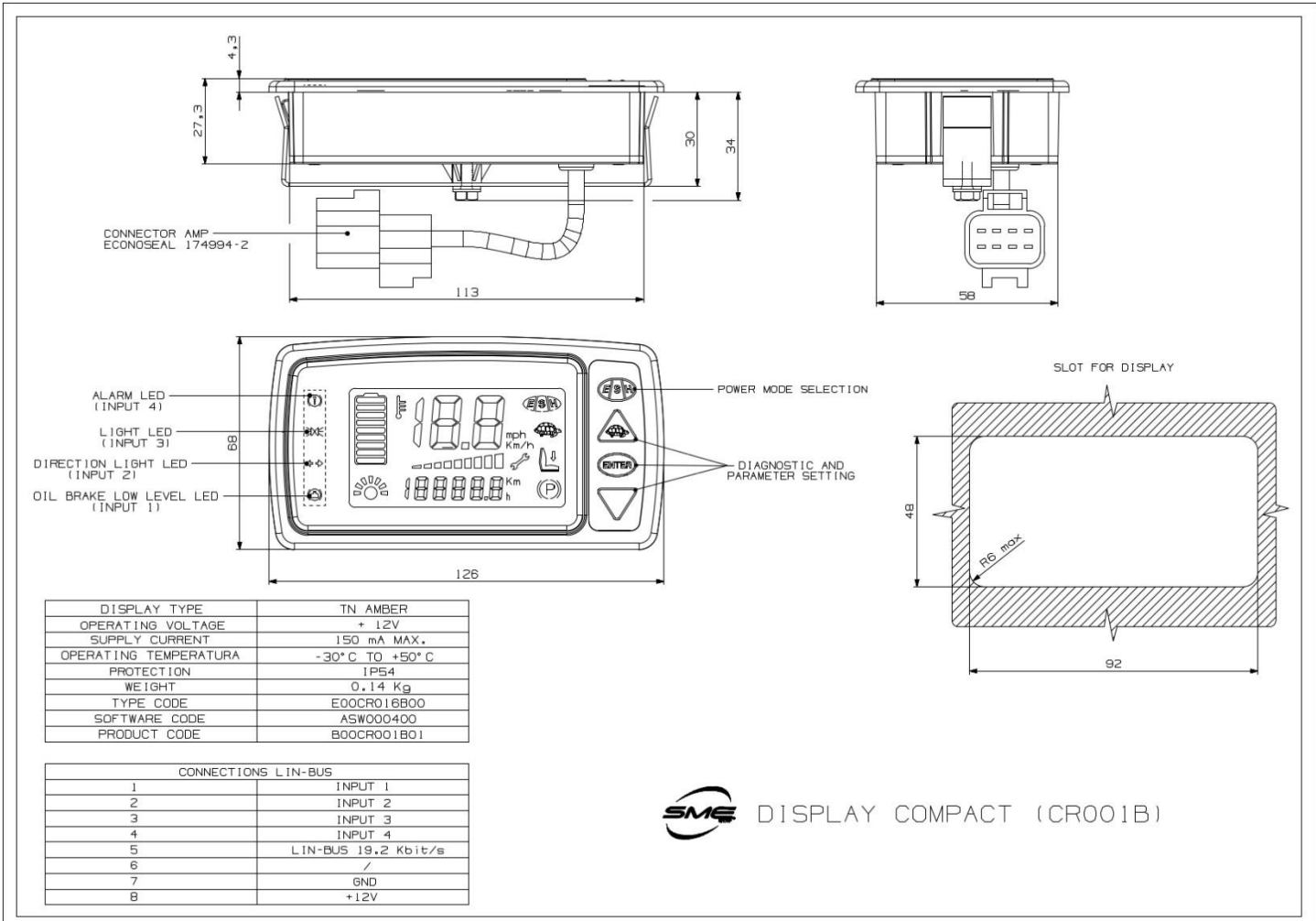


Figure 1. Compact Display Engineering Drawing

Compact Display Pinout

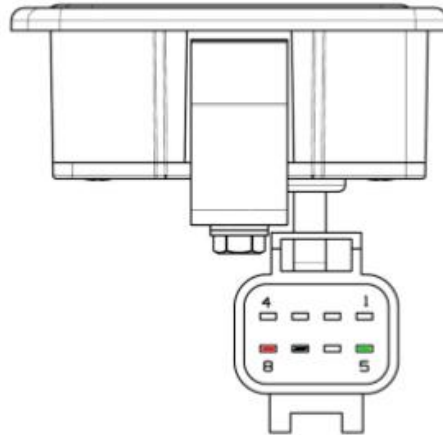
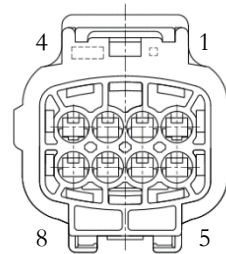


Figure 2. Compact Display Male Connector

Compact Display Female Mating Plug

Add-On for HyPer 9 IS:
Econoseal .070 MK-II 8 POS
 Plug Part# 2822393-1 or 174982-2
 Pin Part# 171662-1 or 171630-1
 Locking Plate Part# 174983



Compact Display - 8 Position Connector		
Pin	Name	Position
8	+12V Out	K1-10
7	I/O Ground	K1-12
6	Not Connected	N/A
5	LIN-BUS	K1-15
4	Digital Input 1	TBD
3	Digital Input 2	TBD
2	Digital Input 3	TBD
1	Digital Input 4	TBD

Figure 3. Compact Display Female Connector

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Diagnostic Mode and Display Keys

Diagnostic Code Lists					
#	Variable Names	Unit	#	Variable Names	Unit
1	Key switch voltage	dV	19	Digital Input 9	Logic state 0/1
2	DC Bus Current	dA	20	Drive Out 1	% if used
3	Capacitors Voltage	dA	21	Drive Out 2	% if used
4	5V Supply	mV	22	Drive Out 3	% if used
5	12V Supply	mV	23	Drive Out 4	% if used
	Analog Input 1 Voltage	mV	24	Digital Out 1	Logic state 0/1 - % duty cycle
7	Analog Input 2 Voltage	mV	25	Digital Out 2	Logic state 0/1 - % duty cycle
8	Analog Input 3 Voltage	mV	26	Motor - Encoder channels	mV
9	Analog Input 4 Voltage	mV	27	Motor - Speed Ref	RPM
10	Analog Input 5 Voltage	mV	28	Motor - Speed	RPM
11	Digital Input 1	Logic state 0/1	29	Motor - Throttle request	%
12	Digital Input 2	Logic state 0/1	30	Motor - Torque	%
13	Digital Input 3	Logic state 0/1	31	Motor - Temperature	°C
14	Digital Input 4	Logic state 0/1	32	Motor - Cutback Temperature	°C
15	Digital Input 5	Logic state 0/1	33	Inverter - Current	dArms
16	Digital Input 6	Logic state 0/1	34	Inverter - Modulation depth	%
17	Digital Input 7	Logic state 0/1	35	Inverter - Temperature	°C
18	Digital Input 8	Logic state 0/1	36	Inverter-Cutback Temperature	°C

Figure 4. Diagnostic Code List

The table below explains the interaction of the user and the display keys.

Key	Function Description
ESH	<p>This function is active only in case of Operating Profile changeable by display.</p> <p>Pressing only the ESH Key for 1s, the Operating Profile will change as described below.</p> <ul style="list-style-type: none"> • Profile 1 -> Profile 2 • Profile 2 -> Profile 3 • Profile 3 -> Profile 1 <p>The ESH Key must be steady pressed, otherwise the Operating Profile will not change.</p>

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UP/TURTLE	<ul style="list-style-type: none">• If the display is in Diagnostic State, by pressing the UP key the user can scroll the diagnostics list of variables.• This function is active only in case of traction speed limiting settable by display. <p>Pressing only the UP/TURTLE key for 200ms, the traction speed will be limited to the value desired.</p>
ENTER	<ul style="list-style-type: none">• If the display is in Diagnostic State, by pressing the ENTER key the display will return to its previous state (before entering Diagnostic one).
DOWN	<ul style="list-style-type: none">• If the display is in Diagnostic State, by pressing the DOWN key the user can scroll the diagnostics list of variables.• If it is enabled the function for trip reset by display and the display is visualizing the trip distance, pressing DOWN key for 5s the trip value will be reset.• If the display isn't in Diagnostic state, pressing the DOWN key the display will enter into its scrolling state. <p>The display will exit from the scrolling state only if the system goes on fault. Otherwise, once entered in this state, the user pressing UP/TURTLE and DOWN keys can visualized cyclically the system time, the system distance, the key-on time and the trip distance.</p>
ENTER & DOWN	<p>Pressing ENTER and DOWN keys together for 2s, the display will enter in Diagnostic mode.</p> <p>In this situation, basic system information such as inputs, outputs, motor/controller temperatures are visualized to monitor these values through COMPACT display.</p> <p>In Diagnostic state, variable list is scrolled through by pressing UP/TURTLE and DOWN keys. To exit from Diagnostic state, the user must press only the ENTER key.</p>

Figure 5. Display Key Interaction

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Fault Code Guide

The **HyPer-Drive X1™** may indicate Fault Codes ranging from *al no.1* to *al no.107*. If the controller is in a fault condition, the Fault Code can be retrieved through your Compact Display, CANBUS Communication, or through any version of the SmartView Software. A list of each code and its level is provided below. For further information on these codes, please refer to the Diagnose tier of SmartView's Help  section, and click on any Fault name for a troubleshooting guide.

- **Level:** anomalous working conditions are indicated by different alarm levels, classified as follows, depending on their effects on the system:






Level	Priority	Action	Icon
Blocking	1 (THE HIGHEST)	<ul style="list-style-type: none"> • Main Contactor: Opened • Motors: Disabled • Outputs: Disabled 	
Stopping	2	<ul style="list-style-type: none"> • Main Contactor: Closed • Motors: Stopped • Outputs: Enabled 	
Limiting	3	<ul style="list-style-type: none"> • Main Contactor: Closed • Motors: Limited • Outputs: Enabled 	
Warning	4 (THE LOWEST)	<ul style="list-style-type: none"> • Main Contactor: Closed • Motors: Enabled • Outputs: Enabled 	
Ready	No Faults	<ul style="list-style-type: none"> • Main Contactor: Closed • Motors: Enabled • Outputs: Enabled 	

Figure 6. Fault Code Level Priority List

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Code	Fault	Set Condition	Level
1	<u>Over Voltage</u>	Key-switch voltage or capacitors voltage is above the maximum level allowed for the controller.	Blocking
2	<u>Under Voltage</u>	Key-switch voltage or capacitors voltage is below the minimum level allowed for the Controller.	Blocking
3	<u>User Over Voltage</u>	Key-switch voltage is above the maximum level defined by the user via related parameter.	Blocking
4	<u>User Under Voltage</u>	Key-switch voltage is below the minimum level defined by the user via related parameter.	Blocking
5	<u>Inverter 1 Over Current</u>	Inverter 1 phase current exceeded its current limit.	Blocking
6	<u>Inverter 2 Over Current</u>	Inverter 2 phase current exceeded its current limit.	Blocking
7	<u>Not Assigned</u>	-	-
8	<u>Inverter 1 Over Temperature</u>	Inverter 1 power module temperature is above +100°C.	Blocking
9	<u>Inverter 2 Over Temperature</u>	Inverter 2 power module temperature is above +100°C.	Blocking
10	<u>Inverter 1 High Temperature</u>	Inverter 1 power module temperature is above +80°C.	Limiting
11	<u>Inverter 2 High Temperature</u>	Inverter 2 power module temperature is above +80°C.	Limiting
12	<u>Inverter 1 Under Temperature</u>	Inverter 1 power module temperature is below -40°C.	Blocking
13	<u>Inverter 2 Under Temperature</u>	Inverter 2 power module temperature is below -40°C.	Blocking
14	<u>Inverter 1 Current Sensor Fault</u>	Current sensor of Inverter 1 measures an invalid offset at key on.	Blocking
15	<u>Inverter 2 Current Sensor Fault</u>	Current sensor of Inverter 2 measures an invalid offset at key on.	Blocking
16	<u>Not Assigned</u>	-	-
17	<u>Inverter 1 Temp Sensor Fault</u>	Difference between Inverter 1 and microprocessor temperature greater than 70°C.	Stopping
18	<u>Inverter 2 Temp Sensor Fault</u>	Difference between Inverter 2 and microprocessor temperature greater than 70°C.	Stopping
19	<u>Motor 1 Over Temperature</u>	Motor 1 temperature is above the Motor 1 Over Temperature defined by the user via related parameter.	Stopping
20	<u>Motor 2 Over Temperature</u>	Motor 2 temperature is above the Motor 2 Over Temperature defined by the user via related parameter.	Stopping

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21	<u>Motor 1 High Temperature</u>	Motor 1 temperature is above the motor Start Cutback Temperature defined by the user via related parameter.	Limiting
22	<u>Motor 2 High Temperature</u>	Motor 2 temperature is above the motor Start Cutback Temperature defined by the user via related parameter.	Limiting
23	<u>Motor 1 Temp Sensor Fault</u>	Motor 1 temperature sensor value is out of permitted range.	Limiting
24	<u>Motor 2 Temp Sensor Fault</u>	Motor 2 temperature sensor value is out of permitted range.	Limiting
25	<u>High Voltage</u>	Key-switch Voltage or Capacitors Voltage is above the Controller Starting Cutback Voltage defined by the user via related parameter.	Limiting
26	<u>Low Voltage</u>	Key-switch Voltage or Capacitors Voltage is below the Controller Starting Cutback Voltage defined by the user via related parameter.	Limiting
27	<u>Microprocessor Over Temperature</u>	Microprocessor temperature is above 125°C.	Blocking
28	<u>+5V Supply Failure</u>	+5V supply is outside the +5V ± 10% range.	Blocking
29	<u>+12V Supply Failure</u>	+12V supply is outside the +12V ± 10% range.	Blocking
30	<u>Encoder 1 Fault</u>	Sin/Cos inputs values are above/below the fault thresholds or spin sensor offset is not right.	Blocking
31	<u>Encoder 2 Fault</u>	Sin/Cos inputs values are above/below the fault thresholds.	Blocking
32	<u>Driver Output 1 Open/Short</u>	Driver Output 1 is either opened or short-circuited.	Blocking
33	<u>Driver Output 2 Open/Short</u>	Driver Output 2 is either opened or short-circuited.	Blocking
34	<u>Driver Output 3 Open/Short</u>	Driver Output 3 is either opened or short-circuited.	Blocking
35	<u>Digital Output 1 Open/Short</u>	Digital Output 1 is either opened or short-circuited.	Blocking
36	<u>Digital Output 2 Open/Short</u>	Digital Output 2 is either opened or short-circuited.	Blocking
37	<u>EEPROM Failure</u>	Error during read/write operation in EEPROM memory.	Blocking
38	<u>EEPROM Corrupted</u>	Memory CRC doesn't match.	Blocking
39	<u>Driver Output 4 Open/Short</u>	Driver Output 4 is either opened or short-circuited.	Blocking
40	<u>PreCharge Circuit Fault</u>	Pre-charge of internal line capacitors is too fast or capacitors voltage is fixed to zero during precharge.	Blocking

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41	<u>PreCharge Failed</u>	Pre-charge phase fails to charge capacitors till the voltage level of key input.	Blocking
42	<u>Main Contactor Welded</u>	Before closing the line contactor, internal capacitors are loaded for short time and voltage doesn't go down.	Blocking
43	<u>Main Contactor Did Not Close</u>	The difference between key switch and capacitors voltage is too high after the contactor has been powered.	Blocking
44	<u>Interlock Disabled</u>	Interlock input is not active and line contactor is open.	Stopping
45	<u>Static Return to Off Traction</u>	One or more traction inputs are active at the key on, after an Emergency stop or a controlled stop procedure.	Warning
46	<u>Static Return to Off Hydraulic</u>	One or more hydraulic/pump inputs are active at the key on after a controlled stop procedure.	Warning
47	<u>Traction Throttle Fault</u>	A fault condition of traction throttle is detected.	Stopping
48	<u>Hydraulic Throttle Fault</u>	A fault condition of hydraulic/pump throttle is detected.	Stopping
49	<u>Brake Throttle Fault</u>	A fault condition of brake throttle is detected.	Stopping
50	<u>Service Time Expired</u>	Service Timer has expired.	Warning
51	<u>Low Battery State of Charge</u>	Battery state of charge estimated is lower than minimum value defined by the user via related parameter.	Limiting
52	<u>Wrong Parameter</u>	Parameter setting is out of the permitted range.	Blocking
53	<u>Restart Required</u>	Changed a parameter setting.	Blocking
54	<u>Can Bus Off</u>	Bus Off condition detected.	Stopping
55	<u>Can Open Circuit</u>	Messages no longer received.	Stopping
56	<u>Can Bad Wiring or Short Circuit</u>	Can bus synchronization phase failed or bus off condition detected.	Blocking
57	<u>Not Assigned</u>	-	-
58	<u>Not Assigned</u>	-	-
59	<u>Not Assigned</u>	-	-
60	<u>Not Assigned</u>	-	-
61	<u>Not Assigned</u>	-	-
62	<u>Net Timeout Heartbeat</u>	At least one Heartbeat hasn't been received during the startup of the network or after the synchronization phase.	Stopping
63	<u>Net RPDO Timeout</u>	At least one PDO hasn't been received.	Stopping
64	<u>Main Contactor Close Command Timeout</u>	Pre-charge timer has expired before the master sends the power ready request.	Blocking
65	<u>Blocking Request From Master</u>	Fault Request is received from Master.	Blocking

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66	<u>Not Assigned</u>	-	Not Assigned
67	<u>Net Startup Timeout</u>	The node hasn't been able to synchronize itself to the network.	Blocking
68	<u>Net External Failure</u>	At least one Node has become not operational.	Stopping
69	<u>Net Mains Manager Wrong Sequence</u>	The Main Contactor Manager has executed a wrong powering procedure.	Blocking
70	<u>Net Mains Manager Precharge Too Slow</u>	DC Bus Voltage will not increase after discharging phase.	Blocking
71	<u>Net Mains Manager Closing Too Slow</u>	The main contactor doesn't close.	Blocking
72	<u>Net Mains Manager Powering Alarm</u>	At least one fault has occurred on Main Contactor Manager Controller.	Blocking
73	<u>CO Synchro Failed</u>	At least one node of the network could be wrong configured or switched off.	Blocking
74	<u>CO Synchro Lost</u>	At least one node of the network could be wrong configured or switched off during operation.	Stopping
75	<u>Stopped For System Fault</u>	Node is stopped because another node has a stopping/blocking fault condition.	Stopping
76	<u>Blocked for System Fault</u>	Node is blocked because another node has a stopping/blocking fault condition.	Blocking
77	<u>BMS Wall Charge</u>	The TAU Node sets a blocking fault.	Blocking
78	<u>BMS Stop</u>	The TAU Node sets a stopping fault	Stopping
79	<u>BMS Fault</u>	The TAU Node sets a blocking fault.	Blocking
80	<u>BMS Limiting</u>	The TAU Node limits its current to the required value from BMS.	Limiting
81	<u>Steering Sensor Fault</u>	A fault condition of steering sensor is detected.	Limiting
82	<u>CAN Protocol Run Time Error</u>	Wrong Request for Driver Outputs	Limiting
83	<u>Programming Required</u>	Controller Firmware Programming	Blocking
84	<u>DigInputs Overvoltage</u>	Digital Input Supply has reached dangerous value	Blocking
85	<u>Inverter Model Not Supported</u>	Inverter model is not supported by the firmware.	Blocking
97	<u>Commission In Progress</u>	Spin sensor commission is in progress	Warning
98	<u>Commission End Success</u>	Spin sensor commission end successfully	Stopping
99	<u>Commission End Errors</u>	Spin sensor commission end with errors	Stopping
100	<u>Internal Software Fault 1</u>	Internal Error.	Blocking

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101	Internal Software Fault 2	Internal Error.	Warning
102	Internal Software Fault 3	Internal Error.	Warning
103	Internal Hardware Fault 1	Internal Error.	Blocking
104	Internal Hardware Fault 2	Internal Error.	Blocking
105	Internal Hardware Fault 3	Internal Error.	Blocking
106	Internal Hardware Fault 4	Internal Error.	Blocking
107	Internal Software Fault 4	Internal Error.	Blocking

Figure 7. Fault Code List

Additional Support

If you need additional support to solve Fault Codes signaled by the firmware or strange behaviors of the vehicle, please contact your Authorized Dealer.

In order to make the collection of information faster, you must provide them:

1. **Product Code** of the Controller.
2. Clone file of the Controller.
3. Screenshots of the **About** Page in the Main Menu.
4. Screenshots of the **Active Faults** Tab in DIAGNOSE
5. Screenshots of the **Faults History** Tab in DIAGNOSE
6. Screenshots of the **Time/Distance** Tab in MONITOR

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Settings

Overview

Setting modifications for the Compact Display are handled in SmartView OEM version that is supplied to all Authorized Dealers. If you need to modify any of the following parameters, please send your controller's current Clone File to your Dealer, along with the list of requested value/setting changes. Below is a list of possible Compact Display settings.

Display's Speedometer Settings

Vehicle Mph or Km/h is represented on the Compact Display. Vehicle Speed is calculated using the Tire Diameter and up to two Gear Ratios. A Digital Input can be assigned and wired to the 2nd Gear sensor for Second Gear speed calculation.

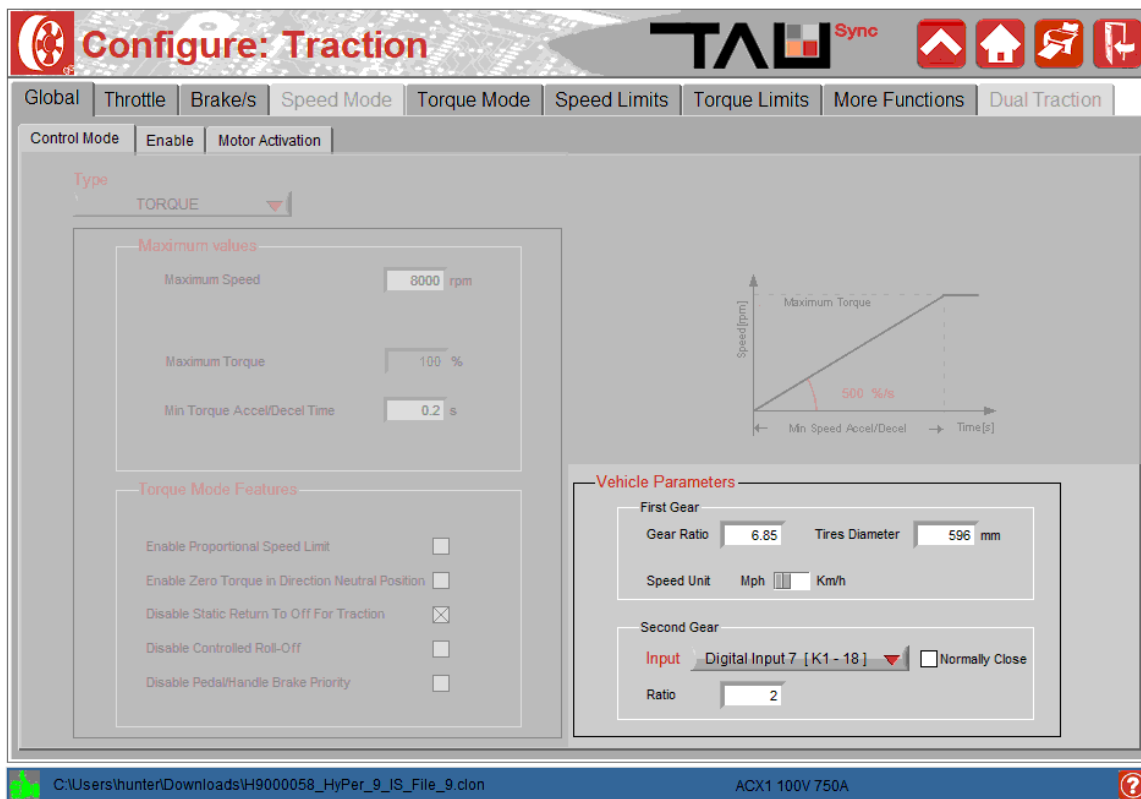


Figure 8. *Configure – Traction – Global – Control Mode*

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Operating Profile Selection Settings

The HyPer-Drive X1 and X144 offer the use of 3 different performance Operating Profiles. These profiles can be cycled through using the Compact Display's (E/S/H) Button, or Digital Inputs.

For HyPer 9 Motor Serial#'s H9000105 and below, Clone files are assigned to select Operating Profile by Compact Display. All other HyPer Motor Serial#'s are currently assigned to select Operating Profile by Switches/Digital Inputs. Follow directions in [Dealer Programming Overview](#) paragraph for changes to your Clone file. (We will soon have a download-able clone file option for this change)

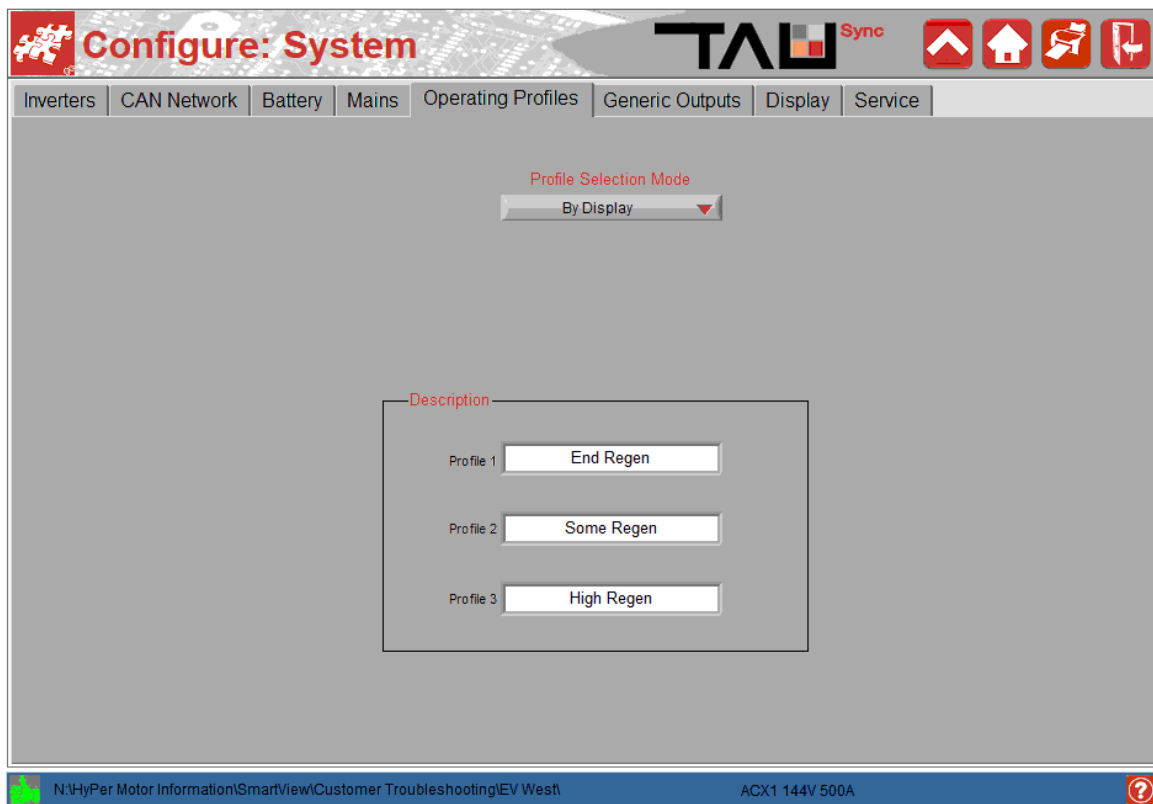


Figure 9. *Configure – System – Operating Profiles*

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Indicator Style Settings

The Compact Display provides a list of system condition indicators. The style of these indicators can be set can be modified on the SmartView OEM *Display* tab.

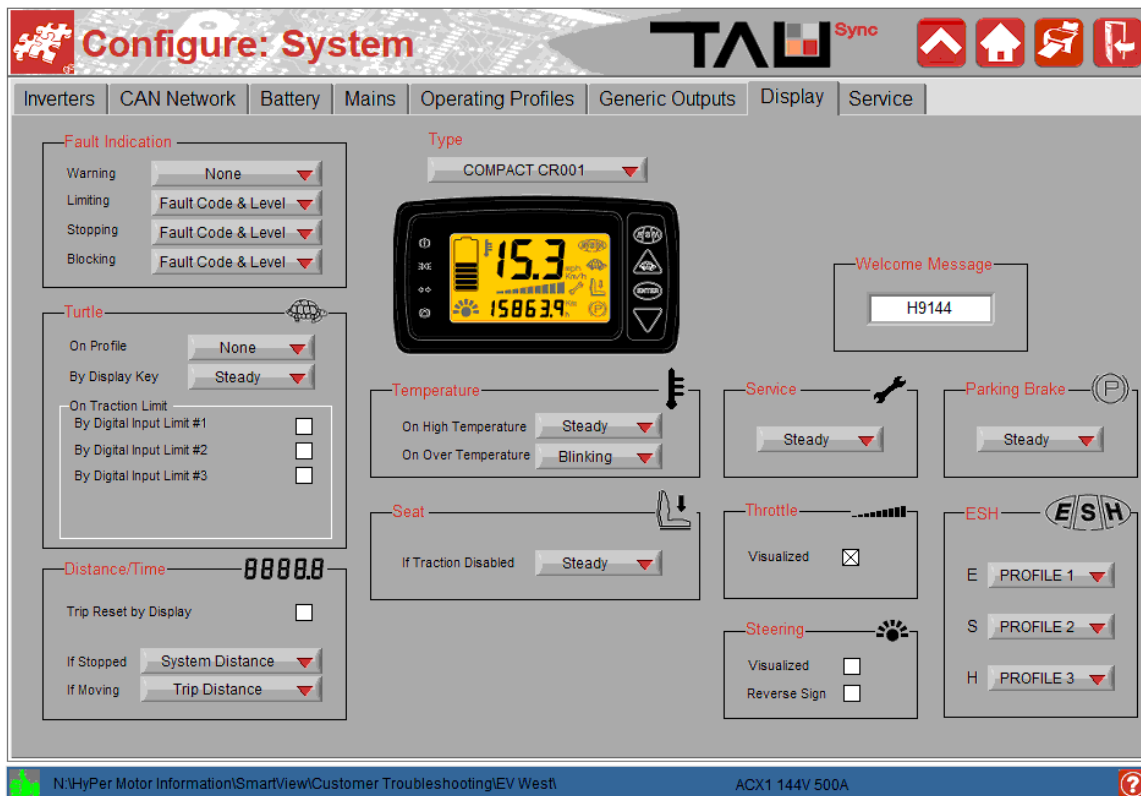


Figure 10. *Configure – System – Displays*

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Notes
