



# **Western Star Cummins PTO Control**

## **L9, X12 & X15**

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# PTO Operation – Engine Features

- Cummins supports PTO operation with many Programmable Settings in the Engine Controller
  - The engine software has a range of flexibility to be parameterized to meet the vehicle needs for PTO Operation
  - Some features can be ordered and programmed at the truck factory, while others must be programmed using INSITE® after the installation has been completed
    - Missing wiring or lack of multiplexed components during truck assembly can cause engine faults, and not allow the vehicle to finish the assembly process
- There can be many ways to operate the engine under PTO Engine Control
  - Determine the best PTO configuration for the PTO Operation
  - Understand what options are available

# PTO Operation – The Basics

- There are two aspects of PTO Operation
  - The Mechanics of Driving a PTO device (such as hydraulic pump)
    - FEPTO, Transmission PTO, REPTO, or Tailshaft/Transfer Case PTO
  - The Control of **Engine Speed** to maintain desired operation of equipment during PTO Operation (not Engine load control)
- These two aspects can be coupled, or mutually exclusive
  - PTO Pumps can be engaged without any interaction with engine
  - Engaging the Engine into PTO Engine Control requires some type of electrical input to the engine:
    - Engine PTO Switch(es) hardwired
    - Engine PTO Switch(es) multiplexed
    - Engine Control with Multiplexed PTO Governor Controller
  - PTO Engine Control uses PTO Governor within the ECM

# PTO Operation – Types of PTO Engine Control

- PTO Operation without PTO Engine Control
  - Used when No Engine Speed Control is required
  - PTO device operates independently of engine speed
  - Typical Systems that use this type of PTO
    - Snow Plows (plow and sand spreader)
- PTO Operation with PTO Engine Control
  - PTO Devices must be controlled at a desired operating speed(s)
  - PTO Governor set to maintain Engine Speed, with variable load, and is tuned differently from Automotive Governor
  - PTO Engine Speed Control can be:
    - Fixed Single Speed
    - Multiple Fixed Speeds
    - Variable Speeds
    - With Accelerator Override

# PTO Operation – PTO Engine Control

- PTO Set Up
  - Cummins engines can support different types of PTO Engine Operation
    - Cab PTO Switches
    - Remote Station PTO Switches
    - Remote PTO Switch
    - Accelerator Override in PTO
    - Vehicle Speed Control in PTO
    - PTO Pump Mode
    - Transmission Driven PTO
  - Things to consider for using PTO Engine Control
    - Engine can distinguish PTO Operation from Engine Idle Operation
    - Other engine operations can be controlled while in PTO Operation
      - Idle Shutdown timers
      - Regen Operation Control
      - On-Board Diagnostics tuned for PTO operation
    - PTO Governor better tuned for low inertia devices
  - Body Builder CEB00511 for more Detailed Information

# PTO Operation – PTO Engine Control

- Cab PTO Switches

- Standard PTO Control Switches are hardwired in the Cab (or a Multiplexed device, can be used by the TEM)
  - Requires these switch inputs
    - PTO On/Off Switch (Must be “On”)
    - PTO Set Speed Switch (Decelerate Switch) (Momentary input from either of these switches)
    - PTO Resume Speed Switch (Accelerate Switch)
  - Allows for variable PTO Speed operation from Min to Max operation within PTO Settings, and ramp rate change
  - PTO is activated at one of two programmable speeds
    - Settings for PTO Set Switch Speed and PTO Resume Switch Speed
- Older Western Star Trucks (and all 4900 X15 installations)
  - PTO Switches common with Cruise Control Switches (hardwired)
- New Western Star Trucks (4700 with L9 & X12 installations)
  - PTO Switches on Steering Wheel common w/ Cruise Control
    - Multiplexed Cruise and PTO Switches

# PTO Operation – PTO Engine Control

- Remote Station PTO Switches
  - Standard PTO Control using hardwired Switches, intended for secondary control outside the Cab
    - Requires these switch inputs must be hardwired
      - PTO On/Off Switch (Must be “On”)
      - PTO Set Speed Switch (Decelerate Switch) (Momentary input from
      - PTO Resume Speed Switch (Accelerate Switch) either of these switches)
    - Allows for variable PTO Speed operation from Min to Max operation within PTO Settings, and ramp rate change
    - PTO is activated at one of two programmable speeds
      - Settings for PTO Set Switch Speed and PTO Resume Switch Speed
  - Cannot be used with Remote PTO
  - For Older Western Star and all 4900 w/ X15
    - This feature is NOT supported, as wiring is spliced into the Cab PTO Switches common with Cruise Control

# PTO Operation – PTO Engine Control

- Remote PTO Switch
  - Fixed Speed PTO Control, with up to 5 discrete PTO Speed Settings
  - Useful for simple PTO operation control
    - Requires single switch input
      - Remote PTO On/Off Switch
    - Allows for fixed PTO Speed operation
      - Intermittent Remote PTO Switch Input toggles to next speed setting
    - Has Priority over the Cab PTO Control
      - Useful when intermittent higher speed or lower speed operation is required, based on hydraulic pressure or PTO loads
    - Cannot be used with Remote Station PTO
    - Easy to implement PTO Engine Control instead of idling
    - Typically, this is a hardwired input to the engine, using the OEM PTO jumper harness



# PTO Operation – PTO Engine Control

- Accelerator Override in PTO
  - Allows for driving a vehicle while in PTO Engine Control
  - Max Engine Speed set within Accelerator Override Settings
    - Equal to or Greater than Max Engine Speed in PTO
  - Can be used with All types of PTO Control
    - Cab PTO, Remote Station PTO and Remote PTO
    - Accelerator Pedal Override has Priority over PTO Speed Control
    - Can be used with Remote Throttle Set up
    - Not available in Emergency Calibrations

# PTO Operation – PTO Engine Control

- Accelerator Override in PTO
  - Watch Outs:
    - If Vehicle Speed exceeds PTO Maximum Vehicle Speed, then Engine will drop out of PTO Engine Control and return to idle speed when Accelerator Pedal is released
    - Accelerator Override may not have same governor stability as PTO Governor

# PTO Operation – PTO Engine Control

- Vehicle Speed Control in PTO

- PTO Engine Control only controls Engine Speed, not Vehicle Speed
- If Vehicle Speed exceeds PTO Maximum Vehicle Speed, then PTO Engine Control will terminate and return to idle speed
- PTO Engine Control can be used up to 20 mph
- If Vehicle Speed control is required, Switched Maximum Vehicle Speed can be used
  - Requires hardwired Input for:
    - Switched Maximum Vehicle Speed
- Watch Outs:
  - Switched Maximum Vehicle Speed cannot be used with Switched Maximum Engine Speed control
  - Switched Maximum Vehicle Speed Switch - Open Circuit is On, Closed Circuit is off (normal max vehicle speed) (Hint: Don't enable this feature without the wiring in place)

# PTO Operation – PTO Engine Control

- PTO Pump Mode
  - PTO Pump Mode used for stationary pumping applications in Oil and Gas Industry
  - Requires additional features and wiring to function
  - Does not work with other types of PTO Controls and some interactions
  - Additional Information Available
    - Refer to CEB00545 – *Stationary Pumping Operations Oil & Gas Applications*

# PTO Operation – PTO Engine Control

- Transmission Driven PTO Control (TDPTO)
  - Large PTO Devices driven thru the transmission w/ transfer case can have higher inertia, greater load fluctuations and more challenging controls
  - Can be unstable with standard PTO Governor
  - There is a feature for Transmission Driven PTO Control that allows for improved PTO Governor Tuning Operation
    - Three Levels of settings: Steady Load, Irregular Load, Cyclic Load
  - Allows Vehicle Speed and Mileage Increment to be disabled, while stationary in PTO Operation (requires Park Brake Switch Input, or Switched Governor Switch Input to engage TDPTO)
  - Tuned for X15 and X12, but may not be not fully tuned for all applications with the L9 engines
  - Requires valid driveline speed input and signal above 0 rpm (ECM Must sense driveline is engaged and turning in PTO)

# PTO Operation – PTO Engine Control

- PTO Control Interlocks
  - Cummins engines have the ability to incorporate interlocks to inhibit and terminate PTO Engine Control
  - Interlocks will disable PTO Engine Control, when enabled and device is activated or threshold is exceeded
    - Clutch
    - Service Brake
    - Maximum PTO Vehicle Speed
    - Transmission Neutral
    - Park Brake
  - Other controls to allow PTO Operation if there are active faults with the vehicle speed sensor signal
    - Ignore Vehicle Speed Source in PTO
    - Zero Vehicle Speed Source Limit
    - **Note** that this allows PTO control without limits on vehicle Speed nor does this stop broadcasting vehicle speed or mileage

# PTO Operation – PTO Engine Control

- Other PTO Control Settings
  - PTO Speeds Settings
    - Minimum Speed
    - Set Switch Speed
    - Acceleration Ramp Rate
    - Remote PTO Speeds  
(up to 5 speed settings)
    - Maximum Speed Setting
    - Resume Switch Speed
    - Maximum Engine Torque
    - Maximum Engine Speed with  
Accelerator Override
  - Alternate PTO Operation – (a.k.a PTO Fire truck)
    - Used with Cab PTO or Remote Station PTO control
    - Engages PTO Speed Control at current engine operating speed, not at preset Set and Resume Speeds, using Set and Resume Switches
    - Operates on Rising edge of switch change of state and will increase or decrease operating speed based on Accelerate or Coast Switch settings in the Cruise Control feature

# PTO Operation – PTO Engine Interface

- Western Star PTO Wiring Harness Information
- All PTO Wiring **MUST** be **Properly Grounded**

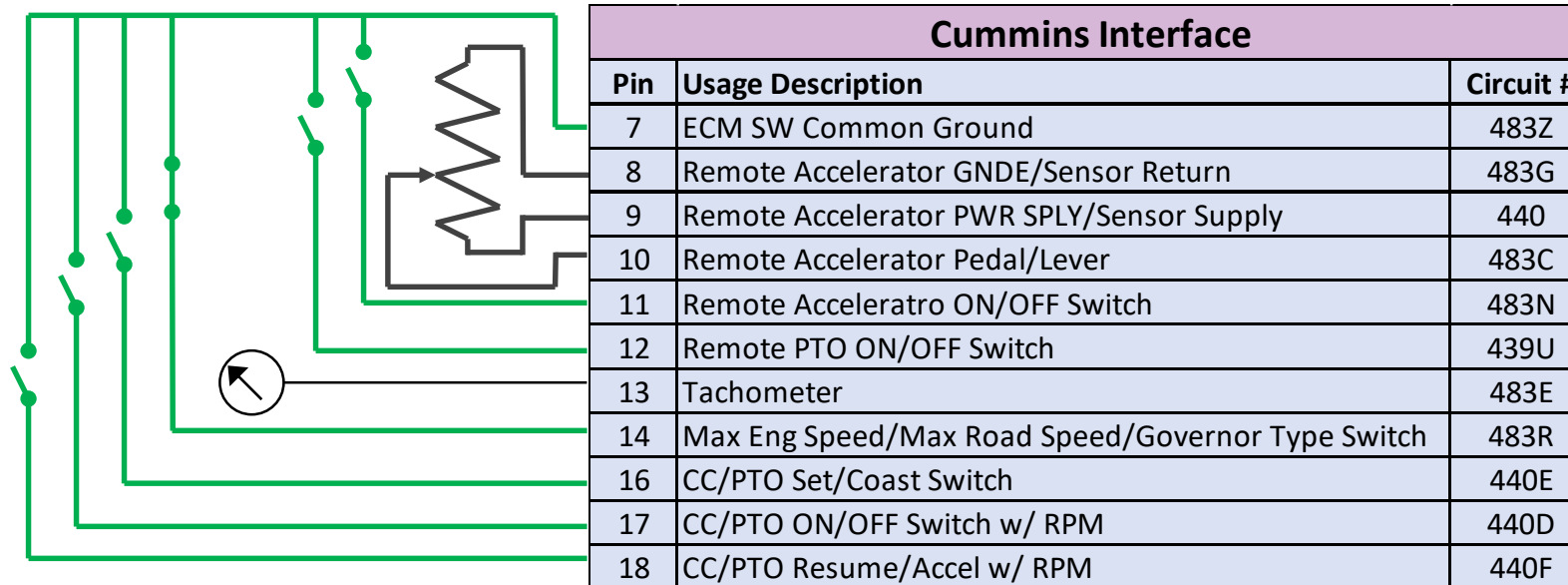
Cummins Interface		
Pin	Usage Description	Circuit #
7	ECM SW Common Ground	483Z
8	Remote Accelerator GNDE/Sensor Return	483G
9	Remote Accelerator PWR SPLY/Sensor Supply	440
10	Remote Accelerator Pedal/Lever	483C
11	Remote Accelerator ON/OFF Switch	483N
12	Remote PTO ON/OFF Switch	439U
13	Tachometer	483E
14	Max Eng Speed/Max Road Speed/Governor Type Switch	483R
16	CC/PTO Set/Coast Switch	440E
17	CC/PTO ON/OFF Switch w/ RPM	440D
18	CC/PTO Resume/Accel w/ RPM	440F



# Western Star PTO Engine Interface

## PTO Wire Harness Wiring Requirements

- All Switches MUST be Grounded thru Pin 7
- Remote Throttle Return Must be Grounded thru Pin 8



# PTO Operation – Wiring

- All PTO Wiring Inputs MUST be Isolated for the Chassis
  - All Switch Inputs MUST use the Cummins Switch Return and not be grounded thru the chassis
  - No Chassis Grounds to be connected to the ECM wiring
  - No External Voltage to be applied to any of the Switch Inputs
- Refer to the Body Builder CEB for more details on Wiring and Electrical Requirements  
CEB00511 CM2350 Electronic Subsystem Technical Package – Body Builders Guide

# PTO Operation – Multiplexing

- Cummins supports J1939 Communication
  - Multiplexing can be used to replace Switch Input
    - All switch inputs can be Hardwired or Multiplexed
  - Multiplexing can replace engine PTO Governor
    - Typically used on fire truck pumpers
    - Highly specialized hardware and software tuning and validation required
- Main Requirements for Multiplexing
  - Cummins adheres to J1939 standard protocols
  - Required inputs for valid signal of switch states
    - “On” or “Off” are Valid
    - “Not Available” or “Error” cause Fault Codes & a Check Engine Lamp
  - Must use Chassis Databus not engine 3-pin service port

# PTO Operation – Multiplexing

- Common Fault Codes associated with Multiplexing
  - FC285 – SAE J1939 Multiplexing PGN Timeout Error
    - Device Not on the Databus (i.e., device not getting power?), or Incorrect Source Address of Device programmed with INSITE®
    - This is like having a street address and there is no building at that address...
    - Typically, this is a Settings issue or electrical issue (power or databus)
  - FC286 – SAE J1939 Multiplexing Configuration Error
    - Device not configured or in error in the set up (switch not installed, but truck (Bulkhead or SmartPlex®) is programmed for switch, usually the result of a “Not Available” J1939 message from the device
    - This is like an “out to lunch” message
    - Typically this is a switch hardware issue or a Bulkhead or SmartPlex® programming error

# PTO Operation – Troubleshooting Multiplexing

- INSITE® has Useful Tool for Troubleshooting Fault Codes Associated with Multiplexing

The screenshot shows the INSITE software interface with the following components:

- Sidebar:** Contains navigation icons for 'Disconnect from ECM', 'Fault Codes', 'Data Monitor/Logger', 'ECM Diagnostic Tests', 'Advanced ECM Data' (highlighted with a red box and arrow), 'Features & Parameters', 'Calibration Selection', 'Work Orders', 'Trip Information', 'Audit Trail', 'Inquire Data Extraction', and 'OBD Monitors'.
- Tree View:** Shows a hierarchy for 'ISB6.7 CM2250' with sub-items like 'Aftertreatment History', 'Engine Protection Setting', and 'SAE J1939 Multiplexed Fault Data' (highlighted with a red box and arrow).
- Main Table:** A table with the following columns: 'Fault Code', 'Multiplexed Component or Data Parameter', 'Status', 'Total ECM Time (Key On Time)', and 'ECM Real Time'. It lists various fault codes and their associated parameters and statuses.
- Callout Box:** A text box with a black border and white background, containing the text: 'Expanding out this field allow user to identify which device is driving the fault code to then further troubleshoot error'. It points to the 'Multiplexed Component or Data Parameter' column.
- Bottom Panel:** A summary table with columns: 'Fault Code', 'Status', 'Count', 'Lamp', 'Description', and numerical values for '587 FMI' and 'J1939 F'. It shows an active fault code 3712 with a red lamp and a description: 'Aftertreatment SCR Operator Inducement - Data Valid But Above Normal Operating Range - Most Severe Level'.

# PTO Operation – Engine Operation

- PTO Loads on Engines

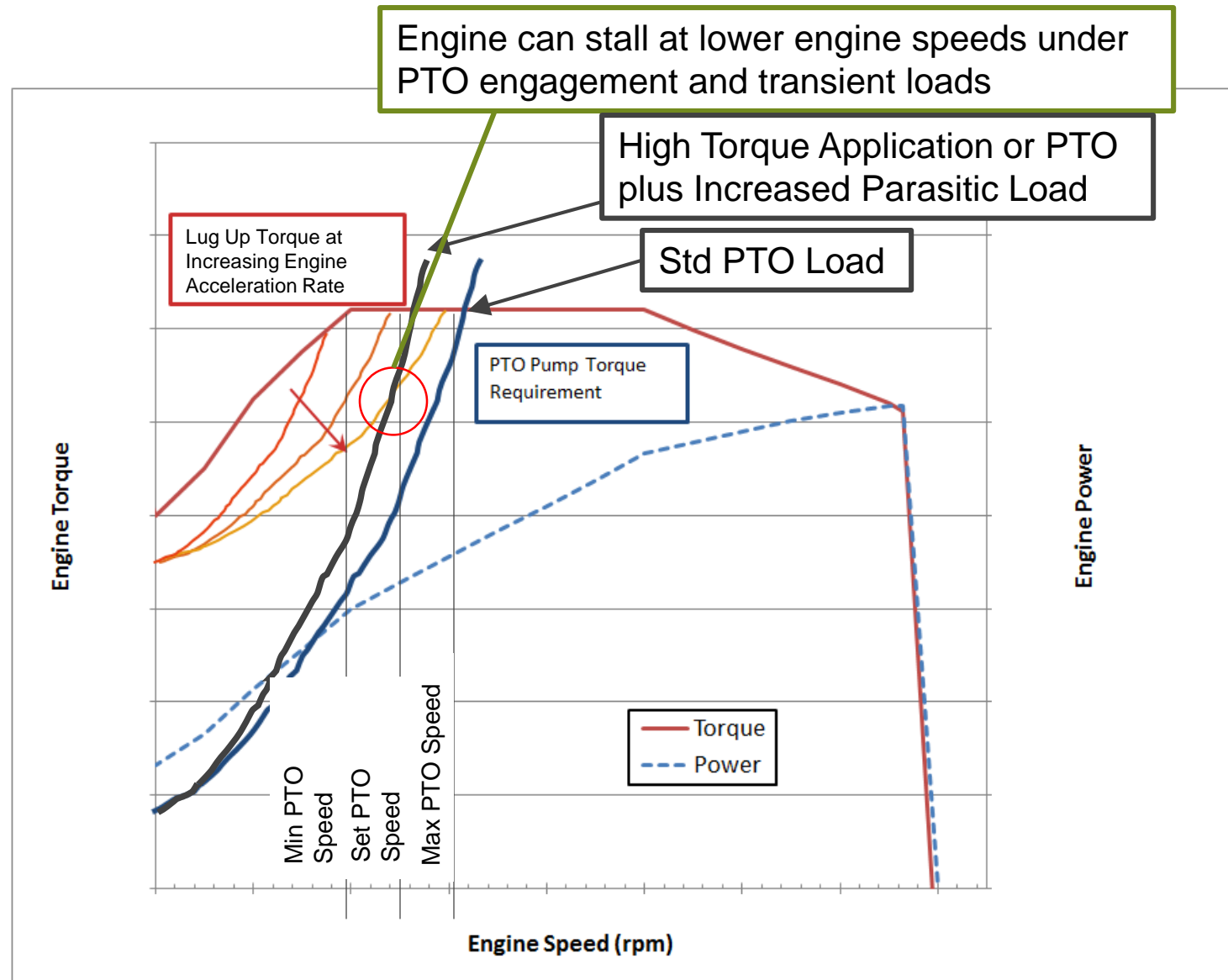
- The PTO Load on the engine must match available engine power
- Total load must be accounted for when matching engine power
  - Fan Power, PTO Pump Parasitics, Vehicle Loads (when mobile)
- Need enough reserve power to handle transient loads
  - Hydraulic devices can have high transient loads, due to changes in pressure

$$\text{Power} = \text{Pump Flow} \times \text{Pump Pressure}$$

$$\text{Torque} = \text{Pump Displacement} \times \text{Pump Pressure}$$

- PTO Engine Governor responds to maintain desired set speed
- Engine fueling will often be limited by Smoke Controls, when operating at lower engine speeds, reducing available torque
- The PTO Engine Governor may not be able to respond to maintain set PTO speed with high transient loads.

# PTO Operation – Engine Operation



# PTO Operation – Regeneration

- Aftertreatment Regeneration in PTO Operation
  - Regeneration in PTO Mode can be programmed in engine controller to allow for regeneration while operating in PTO Mode
  - Regeneration in PTO **DOES NOT** alter engine speed – PTO Speed remains the same
  - High Load operation in PTO control, especially with Auxiliary PTO Controllers, may be unstable with Regeneration in PTO control
  - Equipment Builder and Customer need to determine if high exhaust temps during the regeneration event can be tolerated
  - Can use Regeneration Inhibit Switch to disable regeneration under certain operating conditions
    - Maintain stable engine speed control with high load PTO operation
    - Restrict regeneration events during certain equipment operation



# PTO Operation – Regeneration

- Aftertreatment Regeneration in PTO Operation

- Regeneration in PTO control will occur automatically, as determined by the engine controller – no operator intervention require other than to be in PTO Engine Control
- Mobile Regeneration can also be used to allow for regeneration event outside of PTO operation
  - Minimum Regeneration Speed Threshold Setting above 0 mph requires vehicle to get to 40 mph before regeneration can occur
  - Minimum Regeneration Speed Threshold Setting = 0 mph requires elevated engine speed to start the regeneration

Easy guide is if engine speed is high enough to allow transmission to shift into 2<sup>nd</sup> gear, regeneration will start

# PTO Operation – INSITE Programming

- Programming PTO Control Settings with INSITE®
  - Additional engine feature programming may be required
    - Final wiring completed for some features
    - Multiplexed devices installed
    - Stock trucks not properly set up
    - Additional features not Ordered
  - Engine feature settings can be set using INSITE® Service Tool
    - INSITE Pro or INSITE Lite license required to use
    - Contact your local Cummins Distributor Parts Desk for more information  
[www.cummins.com](http://www.cummins.com)
    - More information available on INSITE (click [here](#))

# PTO Operation – INSITE Programming

- Changing and Enabling PTO Control Settings with INSITE®

The screenshot displays the INSITE 8.0.1.291 software interface. The title bar indicates the engine serial number (73619310) and ECM code (AU90032.01). The main window shows a tree view on the left with 'Features and Parameters' selected. The right pane displays a table of settings for 'Powertrain Protection' and 'PTO'.

Features and Parameters	ECM Value	Units	Original Value
<b>Powertrain Protection</b>	<b>Disable</b>		
<b>PTO</b>	<b>Enable</b>		
Additional Switch Speed	1500	RPM	
Maximum Engine Load	1475	ft*lb	
Maximum Speed	2600	RPM	
Maximum Vehicle Speed	6	mph	
Minimum Speed	700	RPM	
Ramp Rate	250	rpm/s	
Resume Switch Speed	1000	RPM	
Set Switch Speed	800	RPM	
PTO Speed 1 Device			
PTO Speed 2 Device			
PTO Speed 3 Device			
PTO Speed 4 Device			
PTO Speed 5 Device			
PTO Speed 6 Device			
PTO Speed 7 Device			
PTO Speed 8 Device			
<b>Accelerator Pedal or Lever Override</b>	<b>Enable</b>		
Maximum Engine Speed	2600	RPM	
<b>Alternate Operation</b>	<b>Disable</b>		
<b>Cab PTO</b>	<b>Enable</b>		
<b>Clutch Override</b>	<b>Disable</b>		
<b>Ignore Vehicle Speed Source in PTO</b>	<b>Disable</b>		
<b>Parking Brake Interlock Type</b>	<b>None</b>		

The bottom status bar shows 'Connected to ECM' and 'ECM Image'.

# PTO Operation – INSITE Programming

- Changing and Enabling PTO Control Settings with INSITE®

The screenshot displays the INSITE software interface for configuring PTO control settings. The window title is "INSITE 8.0.1.291 - I-20140820-123836694 - Engine Serial Number - 73619310 - ECM Code - AU90032.01". The interface includes a menu bar (File, Edit, View, Tools, Manage License(s), Window, Help) and a toolbar. A left-hand navigation pane lists various diagnostic and programming functions. The main area shows a table of "Features and Parameters" with columns for the parameter name, ECM Value, Units, and Original Value.

Features and Parameters	ECM Value	Units	Original Value
Kamp Rate	250	rpm/s	
Resume Switch Speed	1000	RPM	
Set Switch Speed	800	RPM	
PTO Speed 1 Device			
PTO Speed 2 Device			
PTO Speed 3 Device			
PTO Speed 4 Device			
PTO Speed 5 Device			
PTO Speed 6 Device			
PTO Speed 7 Device			
PTO Speed 8 Device			
<b>Accelerator Pedal or Lever Override</b>	<b>Enable</b>		
Maximum Engine Speed	2600	RPM	
<b>Alternate Operation</b>	<b>Disable</b>		
<b>Cab PTO</b>	<b>Enable</b>		
<b>Clutch Override</b>	<b>Disable</b>		
<b>Ignore Vehicle Speed Source in PTO</b>	<b>Disable</b>		
<b>Parking Brake Interlock Type</b>	<b>None</b>		
<b>PTO Pump Mode</b>	<b>Disable</b>		
<b>Remote PTO</b>	<b>Disable</b>		
<b>Remote Station PTO</b>	<b>Disable</b>		
<b>Service Brake Override</b>	<b>Enable</b>		
<b>Transmission Driven PTO</b>	<b>Disable</b>		
<b>Transmission Neutral Interlock</b>	<b>Disable</b>		
<b>Zero Vehicle Speed Source Limit</b>	<b>Disable</b>		

The bottom status bar indicates "Connected to ECM." and shows the "ECM Image" dropdown menu. The Windows taskbar at the bottom displays the Start button, application icons, a system tray with a battery level of 80%, and the date/time: 2:28 PM, 9/12/2014.

# PTO Operation – INSITE Programming

- Changing and Enabling PTO Control Settings with INSITE®

The screenshot shows the INSITE software interface with the following data table:

Parameter	ECM Value	Units	Original Value
PTO	Enable		
Additional Switch Speed	1500	RPM	
Maximum Engine Load	1475	ft*lb	
Maximum Speed	2600	RPM	
Maximum Vehicle Speed	6	mph	
Minimum Speed	700	RPM	
Ramp Rate			
Resume Switch Speed			
Set Switch Speed			
PTO Speed 1 Device			
PTO Speed 2 Device			
PTO Speed 3 Device			
PTO Speed 4 Device			
PTO Speed 5 Device			
PTO Speed 6 Device			
PTO Speed 7 Device			
PTO Speed 8 Device			
Accelerator Pedal or Lever Override	Enable		
Maximum Engine Speed	2600	RPM	
Alternate Operation	Disable		
Cab PTO	Enable		
Clutch Override	Disable		
Ignore Vehicle Speed Source in PTO	Disable		
Parking Brake Interlock Type	None		

Note – May first need to “Enable” parameter to allow fields to be expanded

# PTO Operation – INSITE Programming

- Changing and Enabling PTO Control Settings with INSITE®

The screenshot displays the INSITE software interface with the following table of parameters:

Parameter	ECM Value	Units	Original Value
Ramp Rate	250	rpm/s	
Resume Switch Speed	1000	RPM	
Set Switch Speed	800	RPM	
PTO Speed 1 Device			
PTO Speed 2 Device			
PTO Speed 3 Device			
PTO Speed 4 Device			
PTO Speed 5 Device			
PTO Speed 6 Device			
PTO Speed 7 Device			
PTO Speed 8 Device			
Accelerator Pedal or Lever Override	Enable		
Maximum Engine Speed	1800	RPM	2600
Alternate Selection	Disable		
Cab PTO	Enable		
Clutch Override	Disable		
Ignore Vehicle Speed Source in PTO	Disable		
Parking Brake Interlock Type			
PTO Pump Mode			
Remote PTO			
Remote Station PTO			
Service Brake Override			
Transmission Driven PTO			
Transmission Neutral Interlock			
Zero Vehicle Speed Source Limit			

To change parameter, use Left Mouse Click in field and type new value and hit "Enter." Original value will appear in the Right Column.

# PTO Operation – INSITE Programming

- Changing and Enabling SAE J1939 Switches with INSITE®

The screenshot shows the INSITE software interface with the 'Features and Parameters' window open. The 'SAE J1939 Multiplexing' section is expanded, showing a list of parameters. The 'PTO On/Off Switch' is highlighted with a red box, and its status is 'Enable'. A callout box provides instructions on how to set parameters.

Parameter Name	ECM Value	Units	Original Value
SAE J1939 Multiplexing			
Acceleration Pedal Lock Switch	Disable		
Acceleration Pedal or Lever Position	Disable		
Aftertreatment Diesel Exhaust Fluid Tank Level Sensor	Disable		
Aftertreatment Diesel Exhaust Fluid Tank Temperature Sensor	Disable		
Aftertreatment Regeneration Permit Switch	Disable		
Aftertreatment Regeneration Start Switch	Disable		
Air Conditioning Pressure Switch	Disable		
Auxiliary Shutdown Switch	Disable		
Clutch Pedal Position Switch	Disable		
Cruise Control On/Off Switch	Enable		
Cruise Control Pause Switch	Enable		
Cruise Control Set/Resume Switch	Enable		
Diagnostic Test Mode Switch	Disable		
Engine Brake Switch Level	Enable		
Engine Protection Shutdown Manual Override	Disable		
Fan Control Switch	Enable		
Fan Control Switch 2	Disable		
Fuel Level Sensor	Enable		
Fuel Level Sensor 2	Disable		
Idle Increment/Idle Decrement Switch	Enable		
Idle Validation Switch	Disable		
Parking Brake	Enable		
PTO On/Off Switch	Enable		

To set parameter, Change to "Enable" and then set Source address to proper address (Decimal values).

# PTO Operation – INSITE Programming

- Changing and Enabling PTO Control Settings with INSITE®

When All required changes and edits to parameters have been completed, select “Send to ECM” Icon and follow instructions on screen

Features and Parameters	ECM Value	Units	Original Value
Ramp Rate			
Resume Switch			
Set Switch Speed			
PTO Speed 1 Device			
PTO Speed 2 Device			
PTO Speed 3 Device			
PTO Speed 4 Device			
PTO Speed 5 Device			
PTO Speed 6 Device			
PTO Speed 7 Device			
PTO Speed 8 Device			2600
Accelerator Pedal or Lever Override	Enable		
Maximum Engine Speed	1800	RPM	
Alternate Operation	Disable		
Cab PTO	Enable		
Clutch Override	Disable		
Ignore Vehicle Speed Source in PTO	Disable		
Parking Brake Interlock Type	None		
PTO Pump Mode	Disable		
Remote PTO	Disable		
Remote Station PTO	Disable		
Service Brake Override	Enable		
Transmission Driven PTO	Disable		
Transmission Neutral Interlock	Disable		
Zero Vehicle Speed Source Limit	Disable		