OPERATING INSTRUCTIONS

for the

AUXILIARY IDLE CONTROL MODULE

Exclusively for Ford Trucks with 7.3L DIT Diesel Engines

Visteon

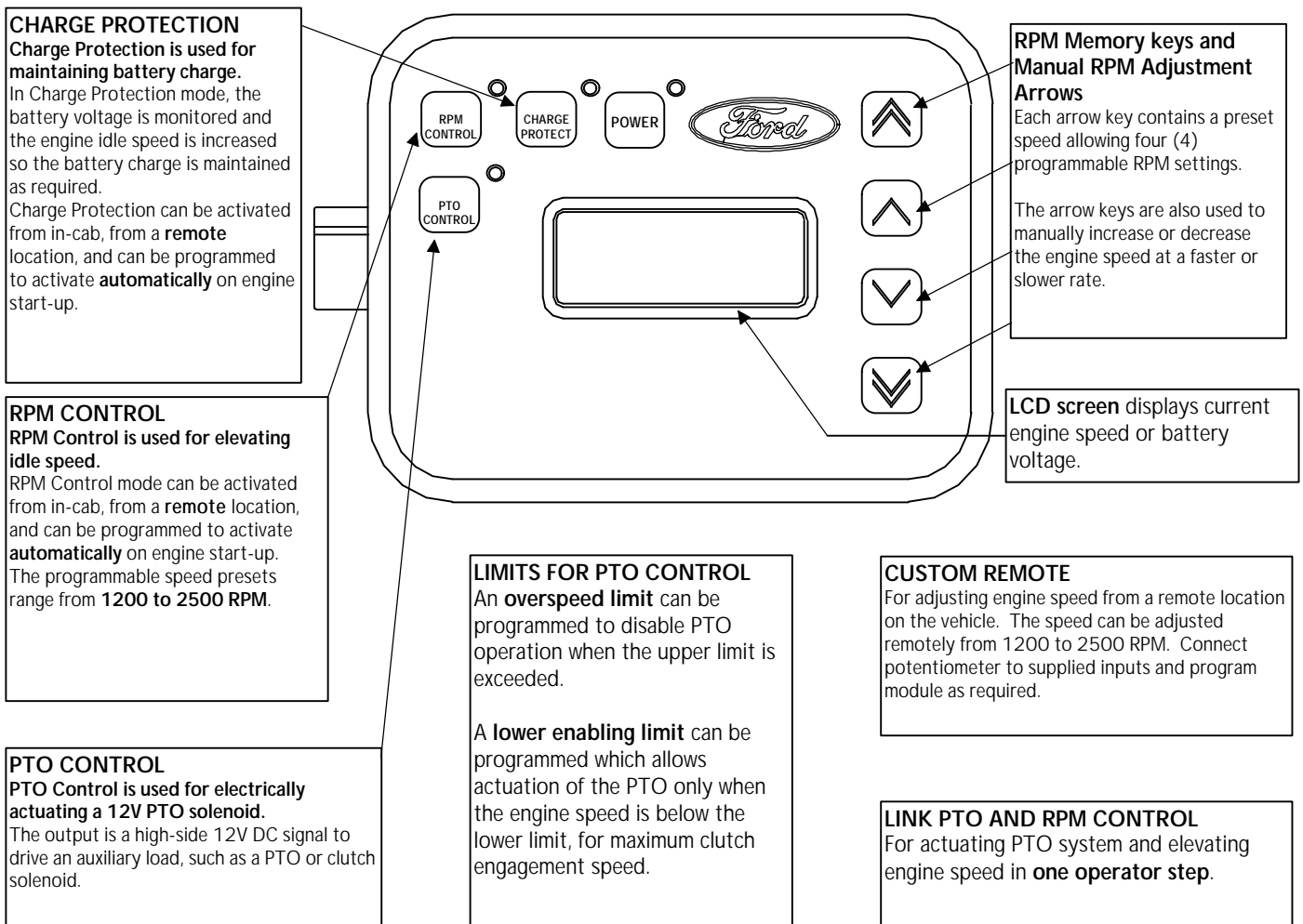An Enterprise of
Ford Motor Company

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Section 1   SYSTEM DESCRIPTION

The Auxiliary Idle Control Module, also called Auxiliary Powertrain Control Module (APCM), is for use in Light Trucks equipped with 7.3L DIT Diesel engines. Each kit includes an Auxiliary Idle Control module, wiring harness, mounting bracket and hardware, operator's card, and this instruction booklet.

The APCM can be used to:
- **Maintain battery charge**
- **Elevate engine speed for increased power output at idle**
- **Power up an auxiliary PTO with optional upper and lower speed limits**
- **Control engine speed from a remote location on the vehicle**
- **Elevate idle speed or maintain charge automatically, without additional driver input**
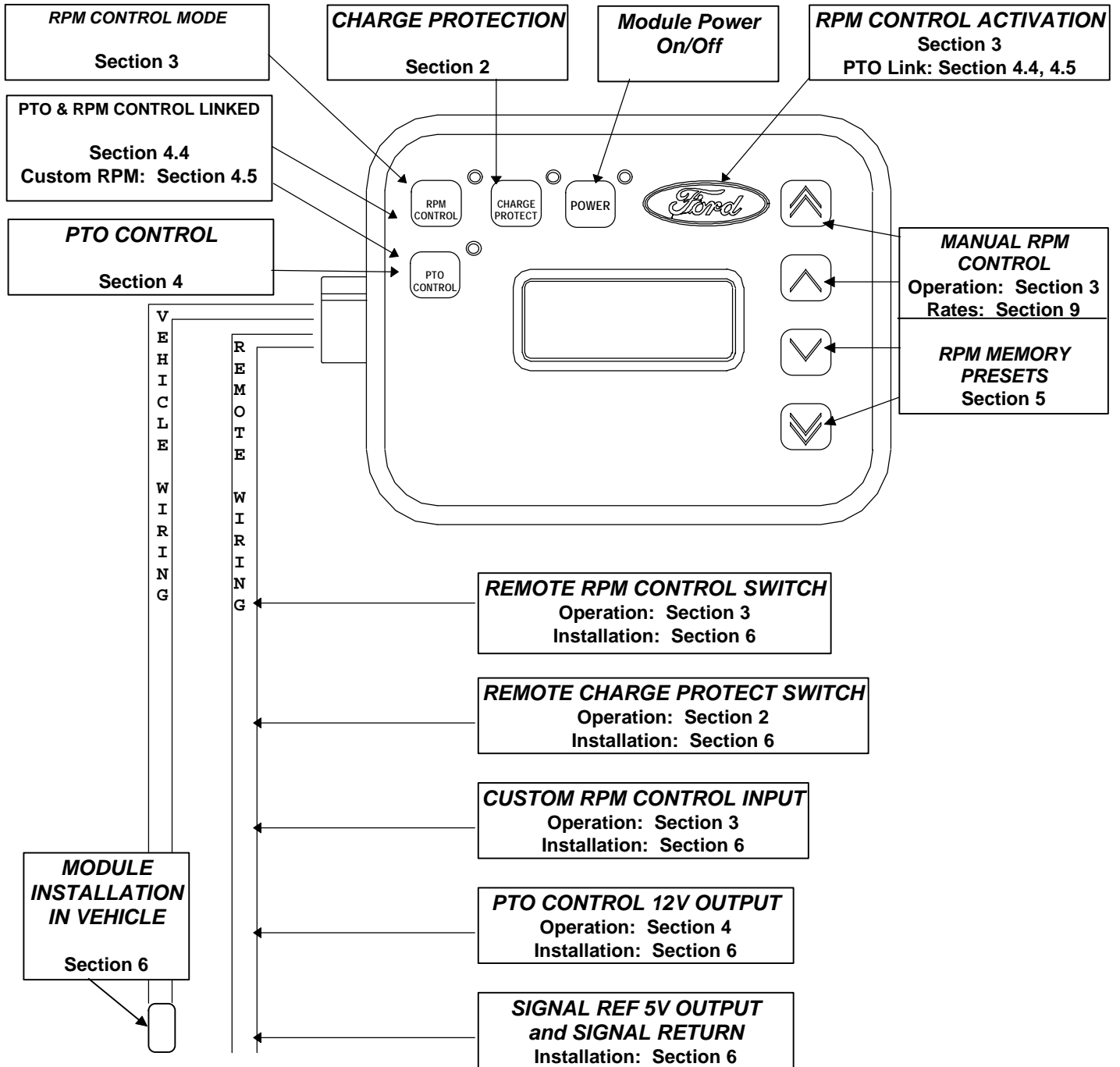
Section 1.1   KEY AND DISPLAY DESCRIPTION

CHARGE PROTECTION
Charge Protection is used for maintaining battery charge.
In Charge Protection mode, the battery voltage is monitored and the engine idle speed is increased so the battery charge is maintained as required.
Charge Protection can be activated from in-cab, from a **remote** location, and can be programmed to activate **automatically** on engine start-up.

RPM CONTROL
RPM Control is used for elevating idle speed.
RPM Control mode can be activated from in-cab, from a **remote** location, and can be programmed to activate **automatically** on engine start-up.
The programmable speed presets range from **1200 to 2500 RPM**.

PTO CONTROL
PTO Control is used for electrically actuating a 12V PTO solenoid.
The output is a high-side 12V DC signal to drive an auxiliary load, such as a PTO or clutch solenoid.

RPM Memory keys and Manual RPM Adjustment Arrows
Each arrow key contains a preset speed allowing four (4) programmable RPM settings.

The arrow keys are also used to manually increase or decrease the engine speed at a faster or slower rate.

LCD screen displays current engine speed or battery voltage.

LIMITS FOR PTO CONTROL
An **overspeed limit** can be programmed to disable PTO operation when the upper limit is exceeded.

A **lower enabling limit** can be programmed which allows actuation of the PTO only when the engine speed is below the lower limit, for maximum clutch engagement speed.

CUSTOM REMOTE
For adjusting engine speed from a remote location on the vehicle. The speed can be adjusted remotely from 1200 to 2500 RPM. Connect potentiometer to supplied inputs and program module as required.

LINK PTO AND RPM CONTROL
For actuating PTO system and elevating engine speed in **one operator step**.

Section 1.2 GUIDE THROUGH THE INSTRUCTION MANUAL

Refer to the following diagram as a guide through the manual.

Each APCM function is listed along with the appropriate Section(s) where detailed information can be found.

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MODULE INSTALLATION IN VEHICLE

Section 6

VEHICLE WIRING

REMOTE WIRING

Section 2   CHARGE PROTECTION MODE

Charge Protection is used for maintaining system voltage.
In Charge Protection mode, the system (battery) voltage is monitored and the engine speed, in RPM, is increased so the voltage is maintained and battery charged as required. Charge Protection mode can be activated from in-cab, remotely, and can be programmed to activate automatically on engine start-up. Charge Protection mode can only be activated with all vehicle interlock conditions met, the APCM is for stationary use only.

Section 2.1   BASIC OPERATION - CHARGE PROTECTION

Step 1 Ensure all vehicle enabling conditions are met.
1. Set parking brake
2. For Manual Transmission, foot off clutch pedal
3. For Automatic Transmission, put gear shift lever in PARK
4. Foot off service brake
5. Foot off accelerator pedal
6. Vehicle is stationary
7. Engine is started and at idle

Step 2 Activate Charge Protection.
- Press **[CHARGE PROTECT]** key [A]
  - » Charge Protect Light will flash
  - » Engine speed will increase to a variable RPM dependent on the battery voltage requirement
  - » Nominal system voltage will be displayed on screen

Exiting Charge Protection
ANY ONE of the following will exit Charge Protection and return engine to idle.
- Press [CHARGE PROTECT] key [A]
- Press [FORD] key
- Press [POWER] key
- Press brake or clutch pedal, take vehicle out of park, or release parking brake

[A] Or a remotely installed Charge Protect switch

Section 2.2   AUTOMATIC OPERATION - CHARGE PROTECTION

Note that Automatic Operation functions only in vehicles equipped with <u>Automatic Transmissions</u>.
With Automatic Charge Protection programmed, the engine speed will be elevated within a few seconds after the vehicle's enabling conditions are met.

Step 1 Program the module for Automatic Charge Protection.
1. Go to main programming mode, press and hold [RPM CONTROL], [CHARGE PROTECT] & [FORD] keys
2. In Menu 1, change the mode from "Base" to "**A CP**" with [ARROW] key.
3. Save and exit programming mode by pressing the [FORD] key.

Step 2 Activate Automatic Charge Protection Mode.
With Automatic Charge Protection programmed, the engine speed will be elevated within a few seconds after programming is exited and the vehicle's enabling conditions are met. **It is not required to press any additional keys on the module for activation.**

To deactivate Automatic Charge Protection *(until key off and key back on)*

> ANY ONE of the following will exit Automatic Charge Protection and return engine to normal idle.
> - Press [CHARGE PROTECT] key **/A**
> - Press [FORD] key
> - Press [POWER] key *
> - Press brake *
> - Take vehicle out of PARK *
> - Release parking brake *

> *   If these are toggled again, the vehicle will re-enter Automatic Charge Protection mode. The others require a key off/restart cycle to restore Automatic or "Power Up" functionality. Keep in mind that Charge Protection can be activated at any time by pressing the [CHARGE PROTECT] key.

To cancel Automatic Charge Protection completely, *you will need to re-program the APCM. (Step 1)*

Section 2.3   REMOTE USAGE - CHARGE PROTECTION

For this module, an input is available to allow remote activation and deactivation of Charge Protection.
The remote switch functions the **same** as the [CHARGE PROTECT] key on the module.

No programming is required for Remote Charge Protection, however the **installation of a remote switch is required**. The switch is not included in the kit. Follow the instructions given in Section 6, "Remote Switch Installation and Usage" for the proper installation of the remote switch.

PLEASE NOTE FOR VEHICLES EQUIPPED WITH AFTERMARKET ALTERNATORS

The adaptive Charge Protection mode for 1999 MY E-Series (Econoline) is calibrated to optimize the voltage regulator output of Ford alternators. Vehicles with non-Ford alternators in Charge Protection Mode may experience battery undercharging or engine speeds that seem excessive.

The recommendation is to use Charge Protection mode with Ford alternators. Otherwise, use RPM Control mode to control engine speed and charge the battery.

Section 3   RPM CONTROL MODE

RPM Control is used for elevating idle speed.
In RPM Control mode, the engine speed can be controlled between 1200 and 2500 RPM. There are four (4) RPM memory settings, manual (up/down) RPM Control, and "Power Up" or Automatic RPM Control.

There are also two remote inputs available for on/off RPM Control and adjustable vernier RPM Control.

Section 3.1 BASIC OPERATION - RPM CONTROL

Step 1 Ensure all vehicle enabling conditions are met.
1. Parking brake is set
2. For Manual Transmission, foot is off clutch pedal
3. For Automatic Transmission, gear shift lever is in PARK
4. Foot is off service brake
5. Foot is off accelerator pedal
6. Vehicle is stationary
7. Engine is started and idling

Step 2 Initiate RPM Control Mode.
- Press **[RPM CONTROL]** key on module.
    - » RPM Control Light will turn on
    - » RPM value stored in Memory #1 is displayed
- If desired, select another RPM memory setting by pressing any [ARROW] key
    - » RPM value stored in the Memory # selected is displayed

Step 3 Activate RPM Control Mode.
- Press **[FORD]** key [B] to activate RPM Control mode
    - » RPM Control Light will flash
    - » Engine speed will increase to the desired RPM
    - » Current engine speed is displayed

Step 4 As desired, adjust RPM manually.
- Use the [ARROW] keys to adjust engine speed up or down.
    The double arrow keys increase or decrease the engine speed at a faster rate.
    The single arrow keys increase or decrease the engine speed at a slower rate.

Exiting RPM Control
ANY ONE of the following will exit RPM Control mode and return the engine to normal idle.
- Press [FORD] key [B]
- Press [RPM CONTROL] key
- Press [POWER] key
- Press brake or clutch pedal, take vehicle out of park, or release parking brake

[B] Or a remotely installed FORD switch

Section 3.2   AUTOMATIC OPERATION - RPM CONTROL

Note that Automatic or "Power-up" operation can function only in vehicles equipped with <u>Automatic Transmissions</u>.

With Automatic RPM Control programmed, the engine speed will be elevated to Memory #1 within a few seconds after the vehicle's enabling conditions are met.

Step 1 Program the module for Automatic RPM Control.
1. Go to main programming mode, press and hold [RPM CONTROL], [CHARGE PROTECT] & [FORD] keys
2. In Menu 1, change the mode from "Base" to "**A Sr**" with ARROW key (press twice).
3. Save by pressing the [FORD] key until programming mode is exited.

Step 2 Activate Automatic RPM Control Mode.
With Automatic RPM Control programmed, the engine speed will be elevated to Memory #1 within a few seconds after the vehicle's enabling conditions are met. It is not required to press any additional keys on the module for activation.

To deactivate Automatic RPM Control
> ANY ONE of the following will exit Automatic Charge Protection and return engine to normal idle.
> - Press [FORD] key **/B**
> - Press [RPM CONTROL] key
> - Press [POWER] key *
> - Press brake pedal, take vehicle out of park, or release parking brake*

> *   If toggled again, the vehicle will re-enter Automatic RPM Control mode. The others require a key off/restart cycle to restore Automatic or "Power Up" functionality. Keep in mind that RPM Control can be activated at any time by pressing the [RPM CONTROL] key followed by the [FORD] key.

To cancel Automatic Charge Protection completely, *you will need to re-program the APCM. (Step 1)*

Section 3.3   REMOTE USAGE - RPM CONTROL

For this module, an input is available to allow remote activation and deactivation of RPM Control.
The remote switch will function the **same** as the [FORD] key on the module.

No programming is required for Remote RPM Control, however **installation of a remote switch is required**.
Follow the instructions in Section 6 for the proper installation of the remote switch.

The Remote Ford switch works nicely with the Custom RPM Control feature discussed in the next section. This allows complete control of the idle speed from a remote location on the vehicle.

Section 3.4 CUSTOM RPM CONTROL

Custom RPM Control allows the user to elevate and adjust the engine speed from a remote location on the vehicle.

Inputs are provided in the wiring harness for an electrical vernier potentiometer-type input.   Correct installation and programming is required for proper operation. Before beginning Custom RPM Control, follow the instructions given in Section 6, "Remote Switch Installation and Usage" for the proper installation of the remote switches.

Also read and understand the specifications in Section 9, for the proper transfer function for custom input voltage to engine speed RPM output. For additional programming options, refer to Section 5 of this manual.

Step 1 Program the module for Custom RPM Control.
1. Go to main programming mode, press and hold [RPM CONTROL], [CHARGE PROTECT] & [FORD] keys
2. Go to Menu 5 by pressing the [FORD] key four (4) times.
3. Change the mode from "Base" to "**Cust**" by pressing any [ARROW] key.
4. Save and exit programming mode by pressing the [FORD] key.

Step 2 Initiate Custom RPM Control.
- The **RPM Control light will turn on steady** when Custom RPM Control mode is programmed.
   » RPM value associated with the Custom Input Voltage is displayed
      ⇒ If within range (0.5 to 4.5 Volts), display shows value of engine speed for input voltage.
      ⇒ **If input is above or below voltage range, display shows <u>OFF</u>**

Step 3 Activate Custom RPM Control.
- Press **[FORD]** key or installed Remote FORD switch to activate Custom RPM Control mode
   » RPM Control Light will flash
   » Engine idle is elevated to the RPM value associated with input voltage
   » Current engine speed is displayed

Step 4 As desired, adjust idle speed manually.
- As input voltage is adjusted, engine speed value adjusts accordingly.

Exiting Custom RPM Control
   ANY ONE of the following will exit Custom RPM Control and return engine to normal idle.
- Press Remote FORD switch *
- Press [FORD] key *
- Press [POWER] key
- Press [RPM CONTROL] key **
- Out-of-Range Custom Voltage Input (<0.5V or >4.5V)
- Press brake or clutch pedal, take vehicle out of park, or release parking brake

  * If [FORD] keys are pressed again, the vehicle will re-enter Custom RPM Control mode.

  ** Pressing the [RPM CONTROL] key will return to Basic RPM Control mode (Section 3.1) until next run cycle.

Section 3.5 AUTOMATIC OPERATION - CUSTOM RPM CONTROL

Automatic Custom RPM Control allows the user to elevate the engine speed automatically, and also adjust the engine speed from a remote location on the vehicle. Inputs are provided in the wiring harness for an electrical vernier potentiometer-type input.   Correct installation and programming is required for proper operation. Be sure to read and understand Custom RPM Control operation outlined in Section 3.4 before proceeding.

Step 1 Program the module for Automatic Custom RPM Control.
1. Go to main programming mode, press and hold [RPM CONTROL], [CHARGE PROTECT] & [FORD] keys
2. In Menu 1, change the mode from "Base" to "**A Sr**" with [ARROW] key.
3. Go to Menu 5 by pressing the [FORD] key four (4) times.
4. Change the mode from "Base" to "**Cust**" with [ARROW] key.
5. Save and exit programming mode by pressing the [FORD] key.

Step 2 Initiate Automatic Custom RPM Control mode.
Start the engine. See RPM Control light is on. Display shows the RPM value associated with the Custom input voltage. (If "OFF" is displayed, the voltage input is not within 0.5-4.5V range)
The engine speed will be elevated within a few seconds after vehicle's enabling conditions are met.
It is not required to press any additional keys on the module for activation.

Exiting Automatic Custom RPM Control	
What you do to exit	**What you get** ***And how to re-initiate***
• Press [FORD] key or Remote Ford switch	Normal idle. RPM Control light is on. *Press key/ switch again for high idle (not automatic)*
• Press [RPM CONTROL] key	Normal idle. RPM Control light is off. *Press [RPM] and [FORD] for basic high idle (not automatic)*
• Press [POWER] key	Normal idle. Module turns off. *Press [POWER], will go to high idle automatically.*
• Provide out-of-range custom input voltage	Normal idle. RPM Control light is on. "OFF" is displayed. *Put voltage back into range, will go to high idle automatically.*
• Foot on brake, release parking brake, or take vehicle out of park	Normal idle. RPM Control light is on. *Re-instate vehicle enabler, will go to high idle automatically.*

To cancel out of Automatic Custom RPM Control completely*, you will need to re-program the APCM. (Step 1)*

Section 4   PTO CONTROL MODE

PTO Control is used for electrically actuating a 12V PTO solenoid.
The PTO Control key activates a discrete high side driver in the APCM to power up an auxiliary load, such as a Power Take-Off, electric clutch, or other implement.
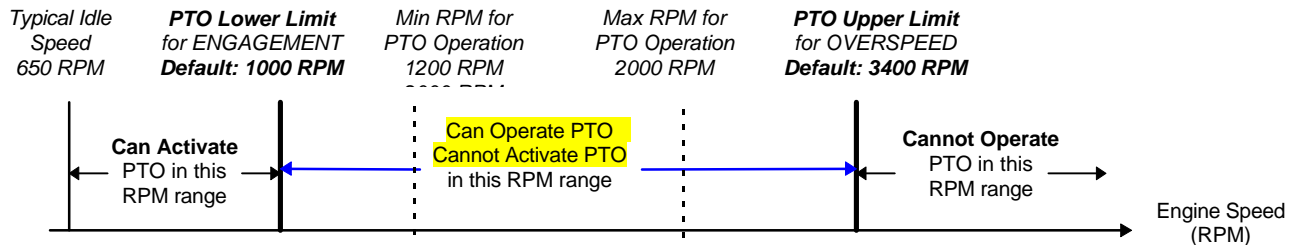
When the application requires the PTO to turn on <u>and</u> run at an elevated engine speed, there is an option to do this called PTO/RPM LINKED. With PTO Control and RPM Control linked, the PTO driver will turn on and engine speed will increase to the desired engine speed. This feature requires programming. Read about PTO/RPM LINKED operation in Section 4.4.

There are also programmable options for lower and upper limits.
The **PTO lower limit** works as "**maximum PTO clutch engagement protection**" by allowing the PTO output driver to turn on only if engine speed is below the programmed lower limit.
The **PTO upper limit** works as "**PTO overspeed protection**" by turning off the PTO output driver whenever the engine speed exceeds the programmed upper limit.

The following diagram shows how the upper and lower PTO speed limits function when programmed.

Typical Idle Speed *650 RPM*	*PTO Lower Limit* *for ENGAGEMENT* *Default: 1000 RPM*	*Min RPM for* *PTO Operation* *1200 RPM*	*Max RPM for* *PTO Operation* *2000 RPM*	*PTO Upper Limit* *for OVERSPEED* *Default: 3400 RPM*

Can Activate PTO in this RPM range

Can Operate PTO Cannot Activate PTO in this RPM range

Cannot Operate PTO in this RPM range

Engine Speed (RPM)

Section 4.1   BASIC OPERATION OF PTO CONTROL

The [PTO CONTROL] key works like a on/off switch. Press the key once to turn on the 12V PTO Control high side driver, and press the key again to turn off.

The PTO output wire must be installed correctly for proper operation. Be sure to read and follow the installation instructions given in Section 6 and the PTO output specifications in Section 9 before proceeding.

Step 1 Activate the PTO Control output.
- Start engine and power up APCM
- Press [PTO CONTROL] key on the module
    - » Light next to PTO Control key turns on
    - » PTO output to the auxiliary load turns on

Exiting PTO Control mode
- Press [PTO CONTROL] key to de-activate
  OR
- Press [POWER] key to de-activate
    - » Light next to PTO Control key turns off
    - » PTO output to the auxiliary load turns off

Section 4.2   PTO CONTROL WITH MAXIMUM ENGAGEMENT PROTECTION

"Maximum PTO clutch engagement protection" can be achieved by utilizing the PTO lower limit on the APCM. The PTO output driver will not be allowed to turn on whenever the actual engine speed exceeds the programmed lower limit. The default is 1000 RPM. Keep in mind the RPM values are <u>engine speeds</u> and proper conversion to PTO speed is necessary (refer to table below for 4R100 applications). If the lower limit is programmed below normal engine idle speed (~650 RPM), the PTO output will not function.

Step 1   Program the PTO lower limit.
1. Go to main programming mode, press and hold [RPM CONTROL], [CHARGE PROTECT] & [FORD] keys
2. Go to the Menu 3 by pressing the [FORD] key twice. "RPM" blinks in the <u>lower</u> left hand corner.
3. Adjust the RPM value with the [ARROW] keys to the desired maximum engagement speed for PTO mode.
4. Save and exit programming mode by pressing the [FORD] key.

Step 2   Activate the PTO Control output.
- Press **[PTO CONTROL]** key on the module
  - » Light next to PTO Control key turns on
  - » PTO output driver turns on (connected to auxiliary load)
  - (PTO Control will not activate unless the current engine speed is less than the PTO lower limit.)

Exiting PTO Control mode
> PTO Control mode can always be exited by pressing the [PTO CONTROL] <u>OR</u> [POWER] keys.
> PTO Control mode will also be exited if the engine speed exceeds the programmed upper limit.

Typical maximum PTO clutch engagement speeds for F-Series with 4R100 PTO Provision

.   Formula: 4R100 PTO Speed ÷ PTO Ratio = Engine Speed

PTO Type	Maximum PTO Engagement Speed	PTO Gear Ratio	**Lower Limit (Engine Speed)**
Chelsea 242 or 244	1500	1.52	**987**
Muncie FA Series	1335	1.335	**1000**

These values are provided for convenience. Refer to the Power Take-Off manufacturer's owners guide for latest specifications.

Section 4.3   PTO CONTROL WITH OVERSPEED PROTECTION

"PTO overspeed protection" can be achieved by using the upper disabling engine limit on the APCM. The PTO output driver will be turned off whenever the actual engine RPM exceeds programmed upper limit. Keep in mind the RPM values are <u>engine speeds</u> and proper conversion to PTO speed is necessary (refer to table below). If the upper limit is programmed below normal engine idle speed (~650 RPM), the PTO output will not function.

Step 1 ***Program the PTO upper limit.***
1. Go to main programming mode, press and hold [RPM CONTROL], [CHARGE PROTECT] & [FORD] keys
2. Go to the Menu 4 by pressing the [FORD] key 3 times. "RPM" blinks in the <u>upper</u> right hand corner.
3. Adjust the RPM value with [ARROW] keys to the desired maximum allowable engine speed for PTO mode.
4. Save and exit programming mode by pressing the [FORD] key twice.

Step 2 ***Activate the PTO Control output.***
- Press **[PTO CONTROL]** key on the module
   » Light next to PTO Control key turns on
   » PTO output driver turns on (connected to auxiliary load)

Exiting PTO Control mode
   PTO Control mode will be exited if the engine speed exceeds the programmed upper limit.
   PTO Control mode can always be exited by pressing the [PTO CONTROL] <u>OR</u> [POWER] keys.

Recommended maximum PTO operational speeds for F-Series with 4R100 PTO Provision

Formula: 4R100 PTO Speed ÷ PTO Ratio = Engine Speed

PTO Type	Maximum PTO **Operation** Speed	PTO Gear Ratio	**Upper Limit (Engine Speed)**
Chelsea 242 or 244	3000	1.52	**1974**
Muncie FA Series	3337	1.335	**2500**

These values are provided for convenience. Refer to the Power Take-Off manufacturer's owners guide for latest specifications.

Section 4.4   PTO LINKED WITH RPM CONTROL

When PTO Control is linked with RPM Control (PTO/RPM LINKED), the PTO output is activated and engine speed is elevated in conjunction with each other. When the RPM Control is commanded off, the PTO output will also turn off.   Conversely, when the PTO output is commanded off, the RPM Control is also turned off and the engine returns to normal idle speed. This feature requires programming.

With PTO/RPM LINKED, the operator can disable both the PTO and the elevated RPM from a remote location on the vehicle. This requires that a remote switch is installed, which is described in Section 6.

Step 1   Program the module for PTO Linked with RPM CONTROL.
1. Go to main programming mode, press and hold [RPM CONTROL], [CHARGE PROTECT] & [FORD] keys
2. Menu 1 should be set to "**BASE**" mode.*
3. Go to Menu 2 by pressing the [FORD] key. See "RPM" and "PTO" on the right hand side.
4. Change the mode from "no" to "**YES**" by pressing any [ARROW] key.
5. Press [Ford] key. Menu 3 shows the programmed PTO Lower Limit.
6. Press [Ford] key. Menu 4 shows the programmed PTO Upper Limit.
7. Menu 5 should be set to "BASE" mode. Press [Ford] key to exit.

   * NOTE: Automatic RPM Control is not available with PTO/RPM LINKED.

Step 2   Initiate PTO Linked with RPM CONTROL mode.
- Press **[RPM CONTROL]** key on module.
  - » RPM Control Light will turn on
  - » RPM value stored in Memory #1 is displayed
  - If desired, select another RPM preset with the [ARROW] keys
    - » RPM value stored in the Memory selected is displayed

Step 3   Activate the RPM Control mode. PTO output will also activate.
- Press **[FORD]** key /B to activate RPM control mode
  - » RPM Control Light will flash
  - » PTO Control Light will turn on.
  - » Engine speed will increase to the desired RPM
  - » Current engine speed is displayed
  - » PTO output turns on and activates the auxiliary load (PTO).

Exiting PTO/RPM LINKED mode
   ANY ONE of the following will exit RPM and PTO Control Linked mode and return the engine to idle.
- Press [FORD] key /B
- Press [RPM CONTROL] key
- Press [PTO CONTROL] key
- Press [POWER] key
- Press brake or clutch pedal, take vehicle out of park, or release parking brake

/B Or installed Remote Ford switch

Section 4.5   PTO LINKED WITH CUSTOM RPM CONTROL

When PTO Control is linked with Custom RPM Control (PTO/CUSTOM RPM LINKED), the PTO and Custom RPM Control operate together. This feature requires programming and remote switch installation.

This feature is useful for applications when it's necessary to turn on the PTO and elevate idle from a remote location on the vehicle. Additionally, with this function programmed, you can turn off the PTO, adjust the idle speed, and return to normal idle. This function is possible because it is not necessary to press the [RPM CONTROL] key or the [PTO CONTROL] key on the module inside the cab.

Step 1   Program the module for PTO Linked with CUSTOM RPM CONTROL.
1. Go to main programming mode, press and hold [RPM CONTROL], [CHARGE PROTECT] & [FORD] keys
2. Menu 1 should be set to "**BASE**" mode.
3. Go to Menu 2 by pressing the [FORD] key. See "RPM" and "PTO" on the right hand side.
4. Change the mode from "no" to "**Yes**" by pressing any [ARROW] key.
5. Press [Ford] key. Menu 3 shows the programmed PTO Lower Limit.
6. Press [Ford] key. Menu 4 shows the programmed PTO Upper Limit.
7. Menu 5 should be set to "**CUSt**" mode. Press [Ford] key to exit.

   NOTE: Automatic RPM Control is <u>not available</u> with PTO/RPM LINKED.

Step 2   Initiate PTO Linked with CUSTOM RPM CONTROL mode.
- The <u>RPM Control light will turn on steady automatically</u> when Custom RPM Control mode is programmed.
    - » RPM value associated with the Custom Input Voltage is displayed
        - ⇒ If within range (0.5 to 4.5 Volts), display shows value of engine speed according to voltage input
        - ⇒ If input is below or above voltage range, display shows "OFF"

Step 3   Activate the Custom RPM Control mode. PTO output will also be activated.
- Press **[FORD]** key or installed Remote FORD switch to activate RPM Control mode
    - » RPM Control Light will flash
    - » Engine idle is elevated to the RPM value associated with input voltage
    - » Current engine speed is displayed

Exiting PTO/CUSTOM RPM LINKED
   ANY ONE of the following will exit Custom RPM Control and return engine to normal idle.
- Press Remote FORD switch *
- Press [FORD] key *
- Press [PTO CONTROL] key
- Out-of-range Custom Voltage Input (<0.5V or >4.5V)
- Press [POWER] key
- Press [RPM CONTROL] key **
- Press brake or clutch pedal, take vehicle out of park, or release parking brake

 * Press [FORD] key to re-activate PTO/Custom RPM Control mode.

** Pressing the [RPM CONTROL] key will exit Custom RPM mode until the next key off/key on cycle.
PTO/RPM Control mode (Section 4.4) can be activated by pressing the [RPM CONTROL] then [FORD] key.

Section 5   PROGRAMMING THE APCM

This section describes how the Auxiliary Powertrain Control Module can be programmed.

Section 5.1   DESCRIPTION AND DEFAULT SETTINGS

DEFAULT SETTINGS

The unit is shipped with the following settings pre-programmed:

- RPM Memory Settings are: (1) 1787 (2) 1300 (3) 2100 (4) 2500 RPM
- Automatic Charge Protection is OFF
- Automatic RPM Control is OFF
- PTO and RPM Control is NOT LINKED
- Enabling Lower Limit is 1000 (PTO clutch will engage whenever the PTO button is pressed)
- Disabling Upper Limit is 3400 (PTO clutch will not disengage at high engine speeds)
- Custom Remote RPM Control is OFF
- Initial Ramp Rate is set to 500 RPM/second (displays 88 on screen)
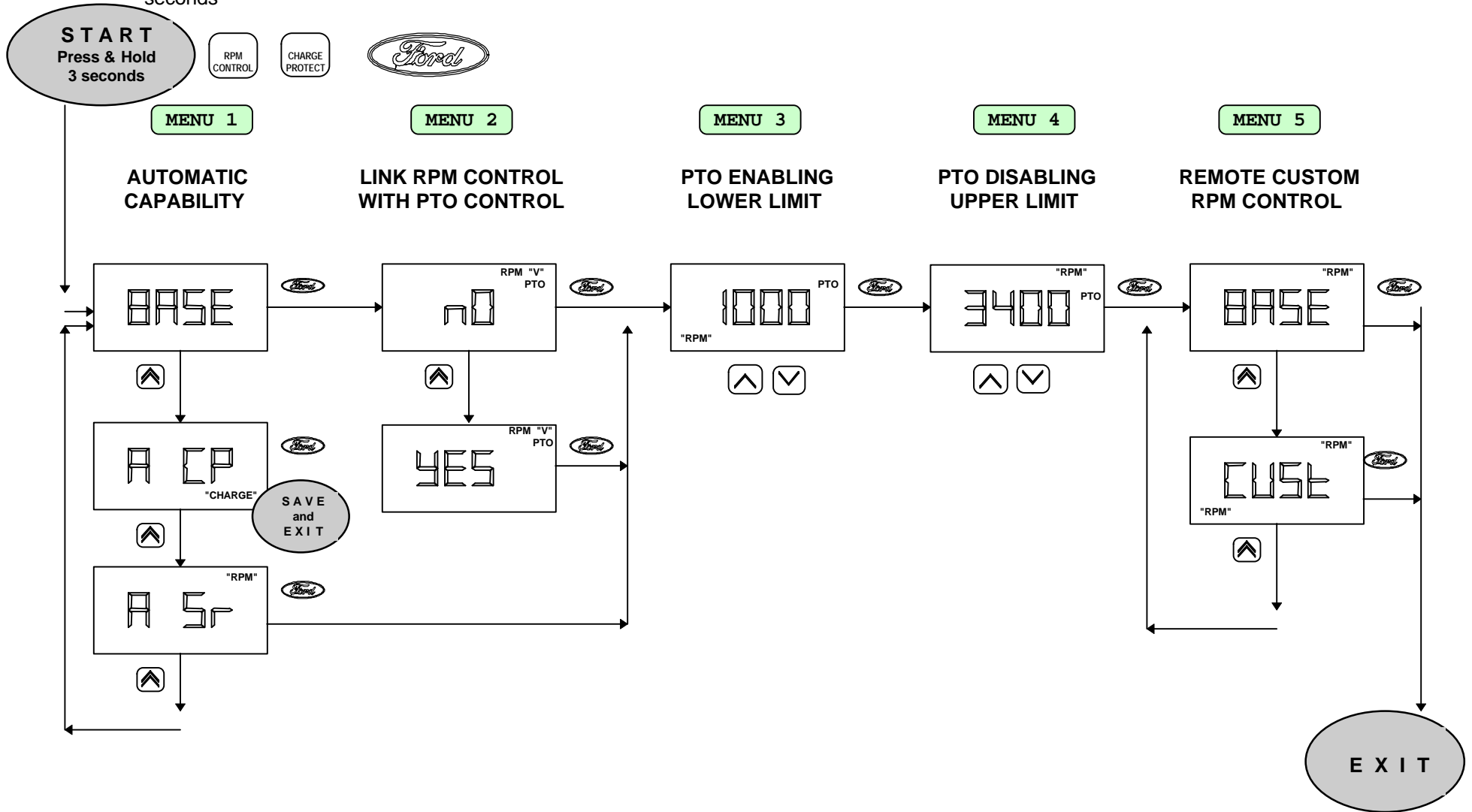
Section 5.2   APCM MAIN PROGRAMMING MODE

The required programming steps for each of the module functions is covered in each respective section.
The diagram on the following page provides an graphical overview of the main programming mode.
The table below summarizes the required programming for each APCM function.

| APCM Function	Automatic Idle Control	PTO/RPM Linked	PTO Lower Limit	PTO Upper Limit	Custom RPM Control
	Menu 1	**Menu 2**	**Menu 3**	**Menu 4**	**Menu 5**
Default	**BASE**	**no**	**1000**	**3400**	**BASE**
Charge Protection RPM Control PTO Control	**BASE**	no	####	####	BASE
Automatic Charge Protection	**A CP**	n/a	n/a	n/a	n/a
Automatic RPM Control	**A Sr**	no	n/a	n/a	BASE
Custom RPM Control	BASE	no	n/a	n/a	**CUST**
PTO/RPM Linked	BASE	**YES**	####	####	BASE
PTO/Custom RPM Linked	BASE	**YES**	####	####	**CUST**

APCM MAIN PROGRAMMING MODE DIAGRAM

- Press [RPM CONTROL], [CHARGE PROTECT], and [FORD] keys <u>simultaneously</u> for three (3) seconds to start programming
- Press [FORD] key to save and move to the next Menu
- Press any [ARROW] key to select options in each Menu
- To exit programming mode, complete all menus OR press and hold the [RPM CONTROL], [CHARGE PROTECT], and [FORD] keys for 3 seconds

S T A R T
Press & Hold
3 seconds

RPM CONTROL   CHARGE PROTECT   Ford

MENU 1	MENU 2	MENU 3	MENU 4	MENU 5
AUTOMATIC CAPABILITY	**LINK RPM CONTROL WITH PTO CONTROL**	**PTO ENABLING LOWER LIMIT**	**PTO DISABLING UPPER LIMIT**	**REMOTE CUSTOM RPM CONTROL**

MENU 1: BASE → A CP "CHARGE" → A 5r "RPM"

MENU 2: nO (RPM "V" PTO) → YES (RPM "V" PTO)

SAVE and EXIT

MENU 3: 1000 PTO "RPM"

MENU 4: 3400 "RPM" PTO

MENU 5: BASE "RPM" → CUSt "RPM"

E X I T

Section 5.3 RPM PROGRAMMING MODE

Programmable engine speed ranges from a minimum of 1200 RPM to a maximum of 2500 RPM.
The four RPM memories are preset at four intermediate values within the operating range.
These memory presets can be changed in RPM Programming mode or while RPM Control is activated.

Section 5.3.1 MENU OVERVIEW FOR RPM PROGRAMMING MODE
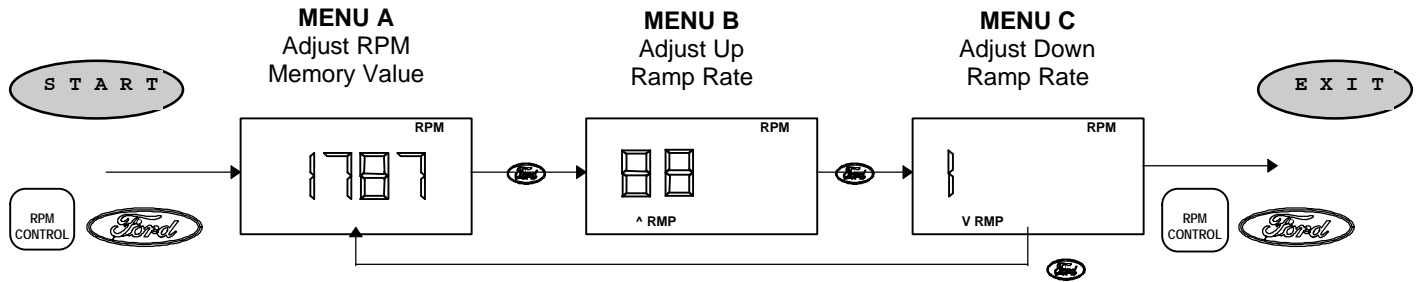
To start programming, press the [RPM CONTROL] and [FORD] keys simultaneously for 3 seconds.
   You'll see 2 lights blink, and the engine speed stored in Memory #1 is displayed. (This is Menu A.)

If you want to change the RPM memory values, Menu A matters to you:
1.   The current saved value for Memory #1 is displayed on the screen.
2.   To select another memory location, press [FORD] and the [ARROW] key simultaneously.
3.   Use [ARROW] keys to adjust the speed until the desired RPM is reached.
4.   Press [FORD] key to enter and save new engine speed.
5.   Press [FORD] key twice to return to Menu 1 and select another memory location. (Go back to Step 1)

To Exit the RPM Programming Mode
*   Press the [RPM CONTROL] and [FORD] key simultaneously for 3 seconds
*   OR Press the [POWER] key.

If you want to change how fast the engine speed ramps up, Menu B matters to you.
(for example, a slow rate of increase for clutch durability, or a fast rate for time efficiency)
The second menu allows the initial ramp up rate to be modified. The up ramp rate is how fast the engine ramps up
to the desired speed. The default value is displayed as "88", meaning it ramps up to the desired elevated idle at a
rate of 500 RPM/second. This default value is adequate for most applications. Refer to Section 9 "Engine Speed
Ramp Rate Table" for specific rate values.

The initial ramp up rate is modifiable with the [ARROW] keys. To save the new ramp up rate modifications, the
[FORD] key must be pressed to enter and save the changes.

Menu C should not be reprogramed:
The third step in RPM programming mode is to adjust the down ramp rate. The down ramp rate is used to help
correct overshoots in engine RPM. Because overshoots are best corrected with the Powertrain Control Module,
this value should not be re-programmed, and should be left at "I" level or lower.

Any RPM memory preset can be also changed while in RPM CONTROL is activated.
After adjusting to the desired RPM value with the ARROW keys, **press and hold the [FORD] key and the
[TOP ARROW] key simultaneously for three (3) seconds** to save the new preset value.

Section 6   INSTALLATION

This section describes the installation procedure for the additional remote circuits available on the Auxiliary Idle Control Module.

The Installation Instruction sheet in the kit describes the set-up of this module to the vehicle, including mounting bracket.   Locate the mating 4-pin connector under the driver's side instrument panel and connect. See Section 9.2 for connector pin-out.

NOTE:
1) DO NOT CUT THE WIRING HARNESS to extend or shorten the harness length.
    Cutting the harness can damage the twisted pair communication lines and result in a non-functional system.
2) It is highly recommended that APCM IS MOUNTED IN-CAB ONLY.
    Install remote switches for all exterior applications.

Section 6.1   REMOTE INPUT SWITCHES

Section 6.1.1 Remote Switch Installation

For Remote RPM Control & Remote Charge Protection, use **Momentary Contact** (push button) switches with **Normally Open** contacts. The switches selected should be able to handle a 5VDC, 20mA nominal signal.
Quality industrial switches with **gold contacts** are recommended for contact durability due to the low current.

> For Remote Charge Protection:
> Connect switch to **red** VREF output wire and **orange** CHG input wire. The Remote Charge Protect switch will function the same as the [CHARGE PROTECT] key on the module.
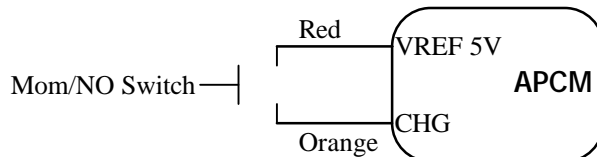
> For Remote RPM Control:
> Connect switch to **red** VREF output and **gray** RPM MC input. The Remote Ford switch will function the same as the [FORD] key on the module for RPM Control activation
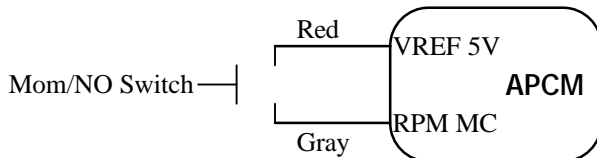
Section 6.1.2 Custom Switch Installation

Custom Remote RPM Control requires a potentiometer type input. The potentiometer or other type of resistor network, is used to adjust the engine speed by providing a voltage between 0.5V and 4.5V to the module. For remote activation, it is recommended that a Remote FORD switch is installed as described above to activate and deactivate Custom RPM Control.

Quality UL recognized industrial switches with **gold contacts** are recommended for contact durability due to the low current.

Programming is required to use the custom switch.
For information on what engine speed (RPM) value corresponds to what custom input voltage (V), refer to Section 9.

For Remote Custom RPM Control:
Connect potentiometer to **red** VREF output, **black** SIG RTN, **pink** CUSTOM input.
The Custom Input Voltage should sweep between 0 and 5V. A 5-10kΩ potentiometer is recommended.
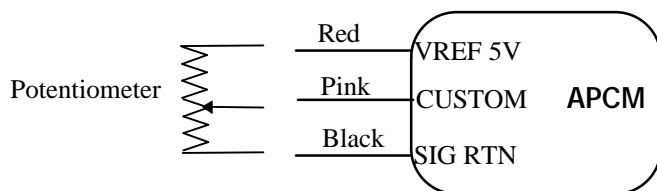
## Section 6.1.3 PTO Control Installation

For 4R100 PTO usage:
Connect the **yellow** PTO output to the 12V PTO solenoid **AND** PTO input circuit to the PCM.
Refer to Ford Body Builders Manual for latest Power Take-Off installation information.

For other electrical loads:
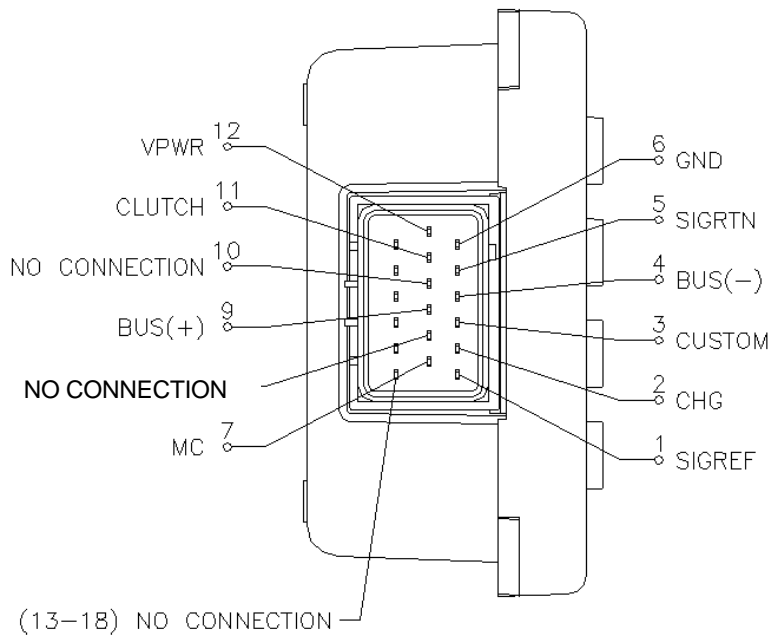Connect the **yellow** PTO output to an external 12V electrical load.

Refer to Section 9 for specifications for the PTO driver output source.
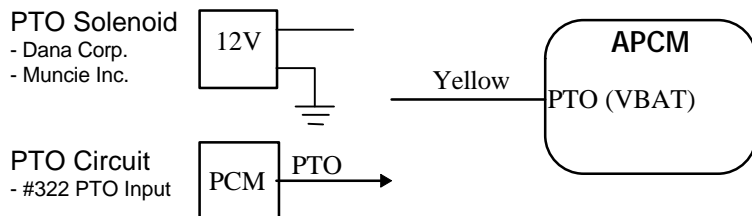
Section 6.2   WIRING HARNESS PIN-OUT TABLE

Connector Position	Wire Color	Signal Description	Notes
1	Red	Signal Reference Voltage 5Vdc	Use for source to remote inputs
2	Orange	Remote Charge Protection Input	Use for Remote CP signal on/off
3	Pink	Remote Custom RPM Input	Use for Remote RPM signal on/off
4	White/Purple	SCP Bus (-) Twisted Pair	Connects to Vehicle
5	Black	Signal Return	Use for Remote Custom Input
6	Black	Ground	Connects to Vehicle
7	Gray	Remote RPM Control Input	Use for Remote RPM Input
8	Plugged		
9	Red/Blue	SCP Bus (+) Twisted Pair	Connects to Vehicle
10	Plugged		
11	Yellow	Power Take-Off Output 12V Source	Use for PTO solenoid and EEC
12	Tan/Red	Ignition Source Power (VPWR)	Connects to Vehicle
13-18	Plugged		

Section 6.2.1 18-Pin Connector Pin-Out Diagram

Section 7 DIAGNOSTICS AND TROUBLESHOOTING

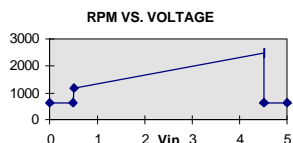| PROBLEM OR SYMPTOM	ACTION
1) No backlight on [FORD] key or [POWER] key	Check power and ground lines.
2) When trying to enter a mode, light next to RPM Control key or Charge Protect key blinks briefly but does not stay lit.	Ensure that ALL of the enabling conditions are met: a) Parking brake set b) Clutch engaged (foot off) or transmission in PARK c) Foot off accelerator d) Brake lights connected and functional With APCM turned off, use NGS Tester to determine if there are any brake or clutch pedal fault codes.
3) Display reads CErr for 5 seconds before normal display activation	Check communication lines for one open or shorted.
4) Display reads CErr	Check communication lines. Check vehicle model year. APCM will not function on vehicles prior to 1995 model year.
5) Display reads CrSd	Check communication lines. Cut SCP wires can cause this error. Replace wiring harness. If communication lines are ok, replace APCM
6) Display reads EErr	APCM component defective, replace APCM
7) Display reads AErr	APCM component defective, replace APCM
8) Must press remote switch twice to activate RPM Control	May have installed wrong type switch. Ensure it's a momentary contact switch, not a single pull/single throw switch. It should be connected to a normally open contact.
9) Remote switch doesn't work at all.	Check for input signal and source voltage lines. Refer to Section 6.1 for proper wiring of remote switches.
10) RPM Control Memories do not work	Check if Custom RPM Control is programmed. If so, in Menu 1 reprogram for Base RPM Control mode (Section 5.2).
11) PTO Control output does not work	Check PTO Lower Limit, if programmed below normal engine idle speed (~650 RPM), PTO will not activate at all. Check PTO Upper Limit, if set too low, PTO will turn off too soon or not activate at all.
12) Display reads "OFF"	Custom RPM Control is programmed and input voltage is less than 0.5 Volts or greater than 4.5 Volts. Check custom input circuit power. Check custom input circuit for opens and shorts. Reprogram module if Custom RPM Control is not desired.

Section 8   FUNCTIONAL SUMMARY

VEHICLE REQUIREMENTS	
Enablers required to activate high-idle modes	- Parking brake engaged - Clutch engaged (foot off) or vehicle in PARK - Service brake off - Foot off accelerator - Brake lights connected and functional
Disablers allowing multiple ways of returning to idle	- Press brake or clutch pedal - Release parking brake - Take vehicle out of PARK - Deselect APCM function - Turn off power to APCM

CHARGE PROTECTION MODE	
Adaptive "Charge Protection" - Remote activation - Programmable automatic activation	- System voltage displayed on LCD screen - Use momentary contact switch - Automatic transmission is required
Minimum RPM for Charge Protection	- 1100 RPM (1998 MY Econoline) - 1200 RPM (1999 MY F-Series) - 1300 RPM (All previous Model Years for E/F-Series)
Maximum charge rate	- 2500 RPM

RPM CONTROL MODE	
Selectable high idle operation with closed-loop engine speed control	- System RPM displayed on LCD screen
Programmable RPM memories	- 4 presets
Minimum programmable RPM Maximum programmable RPM	- 1200 RPM - 2500 RPM
Manual RPM Control	- Slow and fast up and down arrow keys
Remote RPM Control	- On-off to RPM Preset #1
Custom Remote RPM Control	- Adjustable from 1200 to 2500 RPM

PTO CONTROL MODE	
PTO Linked operation with RPM Control	- Activate PTO output and high-idle concurrently
Programmable PTO Overspeed Protection	- Disabling upper limit (full RPM range)
Programmable Clutch Engagement Speed Protection	- Enabling lower limit (full RPM range)

Section 9   SPECIFICATIONS

Section 9.1 CUSTOM INPUT VOLTAGE TO OUTPUT SPEED

Table 9.1.1: Custom Voltage to RPM Function

Input Voltage (V)	Engine Speed (RPM)
<0.5V	(normal idle)
0.5V	1200
1.0V	1360
1.5V	1525
2.0V	1685
3.0V	2010
4.5V	2500
>4.5V	(normal idle)
V = (RPM - 1037.5) / 325	RPM = 325 x V + 1037.5

RPM VS. VOLTAGE

Section 9.2   APCM MODULE HARNESS CONNECTORS

Vehicle Side: Ford Part No. E8EB-14A464-BZA

BUS - (PINK/LIGHT BLUE)
BUS+ (TAN/ORANGE)
GROUND (BLACK)
KEY POWER F-Series (RED/YELLOW) E-Series (RED/LIGHT GREEN)

Module Side: Ford Part No. F3LB-12624-ZB

KEY POWER (TAN/RED)
GROUND (BLACK)
BUS+ (RED/BLUE)
BUS - (WHITE/PURPLE)
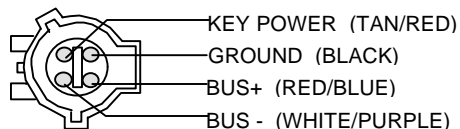
Section 9.3 ENGINE SPEED RATE OF CHANGE TABLES

In RPM Control mode, the engine speed is manually adjustable with the [ARROW] keys.
Table 9.3.1 indicates the rate of change in engine speed for the up/down [ARROW] keys. These are not adjustable.

Table 9.3.1: Manual RPM Rates

[ARROW] key	Symbol	RPM/second
"Fast" up	^^	400
"Slow" up	^	60
"Slow" down	∨	-60
"Fast" down	∨∨	-400

RPM programming mode allows the user to adjust two ramp rates. The default settings are appropriate for most idle control applications. Table 9.3.2 shows the rate of change in RPM for both ramp rates.

The first is the initial ramp up rate ($\wedge$RMP), which is how fast the engine ramps up to the desired speed. For PTO applications, a slower initial ramp up rate may be beneficial for clutch durability. The default value is displayed as "88", meaning it ramps up to the desired elevated idle at a rate of 500 RPM/second.

The down ramp rate ($\vee$RMP) should remain at "I" (100 RPM/sec) or lower.

Table 9.3.2: Engine Speed Ramp Rates

Ramp Rate Setting LCD Display	Ramp Rate RPM/Second
Minimum (None)	25
I	100
E	150
8	240
8I	320
8E	400
88	500
88I	560
88E	650
888	725
888I	800
888E	900
Maximum (8888)	1000

Section 9.4 PTO CONTROL HIGH SIDE DRIVER OUTPUT

PTO Control driver output specification:

Voltage output   = 13.5 V nominal (based on vehicle system voltage, VPWR)
Load Current (ISO)   = 1.8 A
Current Limitation   = 1.5 A

- Reverse battery protection
- Inductive overvoltage output clamp
- Overload protection
- Short circuit protection