

Woodward Governor Company

MotoTron Control Solutions

Hardboot Recovery for Fire48 Family Modules GCM-0563-048-08xx and HCM-0563-048-08xx

This document applies to the following Woodward MCS "Fire48" family ECU control modules:

Woodward Part#	Description	OEM Part#	Memory Layout	Nickname
Part# 1751-6324	GCM-0563-048-0801-CP0	GCM48D0801	"DEV"	"CCM48"
Part# 1751-6326	GCM-0563-048-0801-F00	GCM480801	"PROD"	"CCM48"
Part# 1751-6330	GCM-0563-048-0802-CP0	GCM48D0802	"DEV"	"SIM48"
Part# 1751-6332	GCM-0563-048-0802-F00	GCM480802	"PROD"	"SIM48"
Part# 1751-6352	HCM-0563-048-0801-CP0	HCM48D0801	"DEV"	"TVM48"
Part# 1751-6354	HCM-0563-048-0801-F00	HCM480801	"PROD"	"TVM48"
Part# 1751-6357	HCM-0563-048-0802-CP0	HCM48D0802	"DEV"	"HLA48"
Part# 1751-6358	HCM-0563-048-0802-F00	HCM480802	"PROD"	"HLA48"
Part# 1751-6360	HCM-0563-048-0803-CP0	HCM48D0803	"DEV"	"MII48"
Part# 1751-6361	HCM-0563-048-0803-F00	HCM480803	"PROD"	"MII48"

INTRODUCTION. During software development, sometimes an ECU control module is programmed with an application that does not communicate properly, or that "locks up" the control module. When this happens, the control module may be recovered by activating "program mode" of the hardboot loader when the control module is powered up.

There are two methods to activate program mode of the hardboot loader for Fire48 family (GCM-0563-048-08xx and HCM-0563-048-08xx) ECU control modules.

BOOT KEY method: Use a "Boot Key" (v2.0 or v3.0) to provide 555 Hz square wave input signal to the STOP pin at control module power-up.

BOOT CABLE method: Set the analog inputs to a specified configuration of "pull-up" to 5 volts and "pull-down" to ground. This is typically done with a "Boot Cable" (available from Woodward) but may be accomplished using a user-configured custom cable, "pigtail" harness, development harness, Breakout Box, or the Woodward MCS Desktop Simulator.

The procedures described in this document implement the two recovery methods in several different ways, depending on available equipment. Any of these procedures may be used.

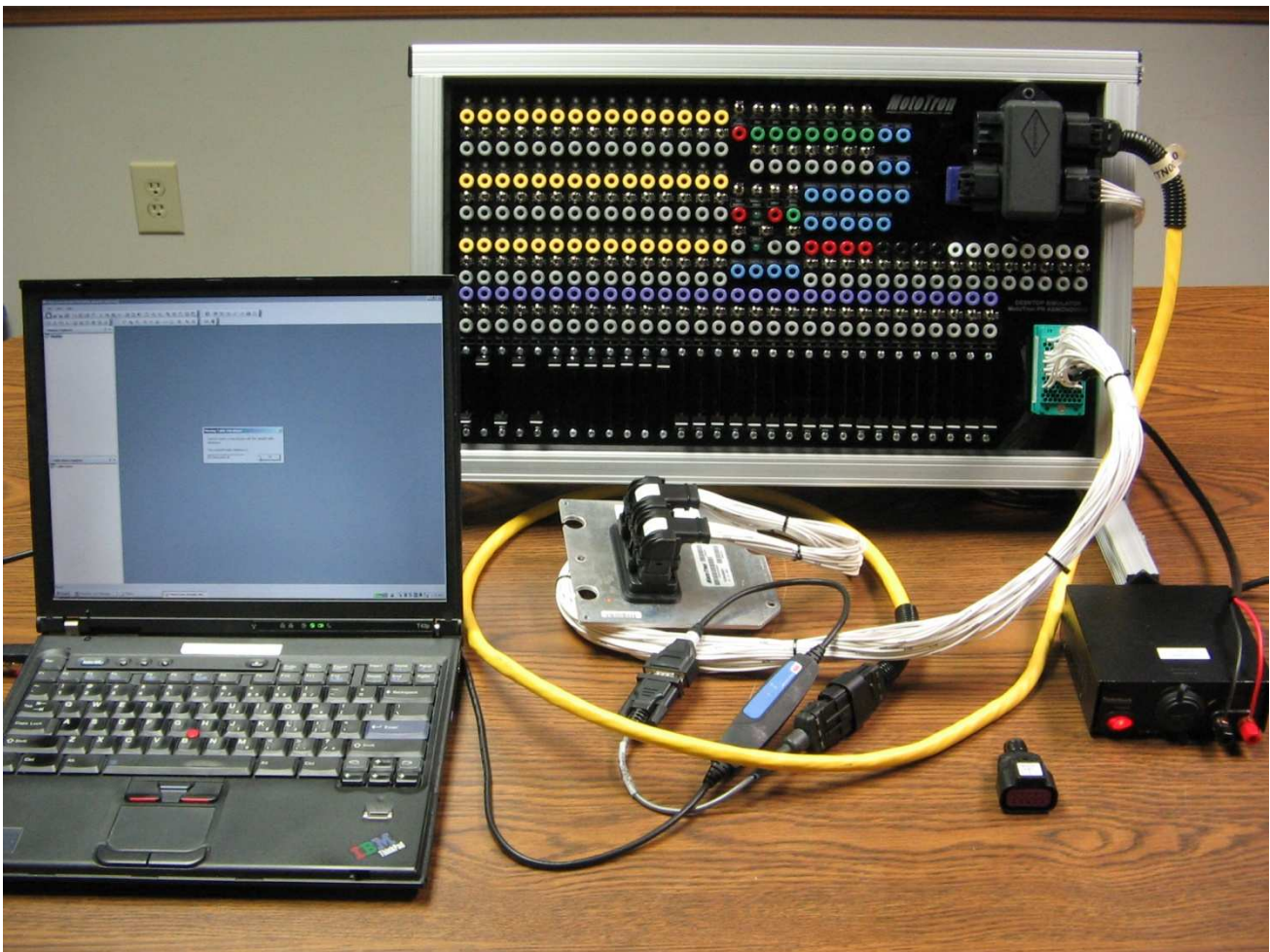
Procedure 1 (BOOT KEY method): use Boot Key (v2.0 or v3.0) with Quick Programming Cable.

Procedure 2 (BOOT KEY method): use Boot Key (v2.0 or v3.0) with Desktop Simulator.

Procedure 3 (BOOT CABLE method): use Boot Cable.

Procedure 4 (BOOT CABLE method): set Desktop Simulator analog inputs to Boot Cable configuration.

Procedure 5 (BOOT CABLE method): set Breakout Box to Boot Cable configuration.

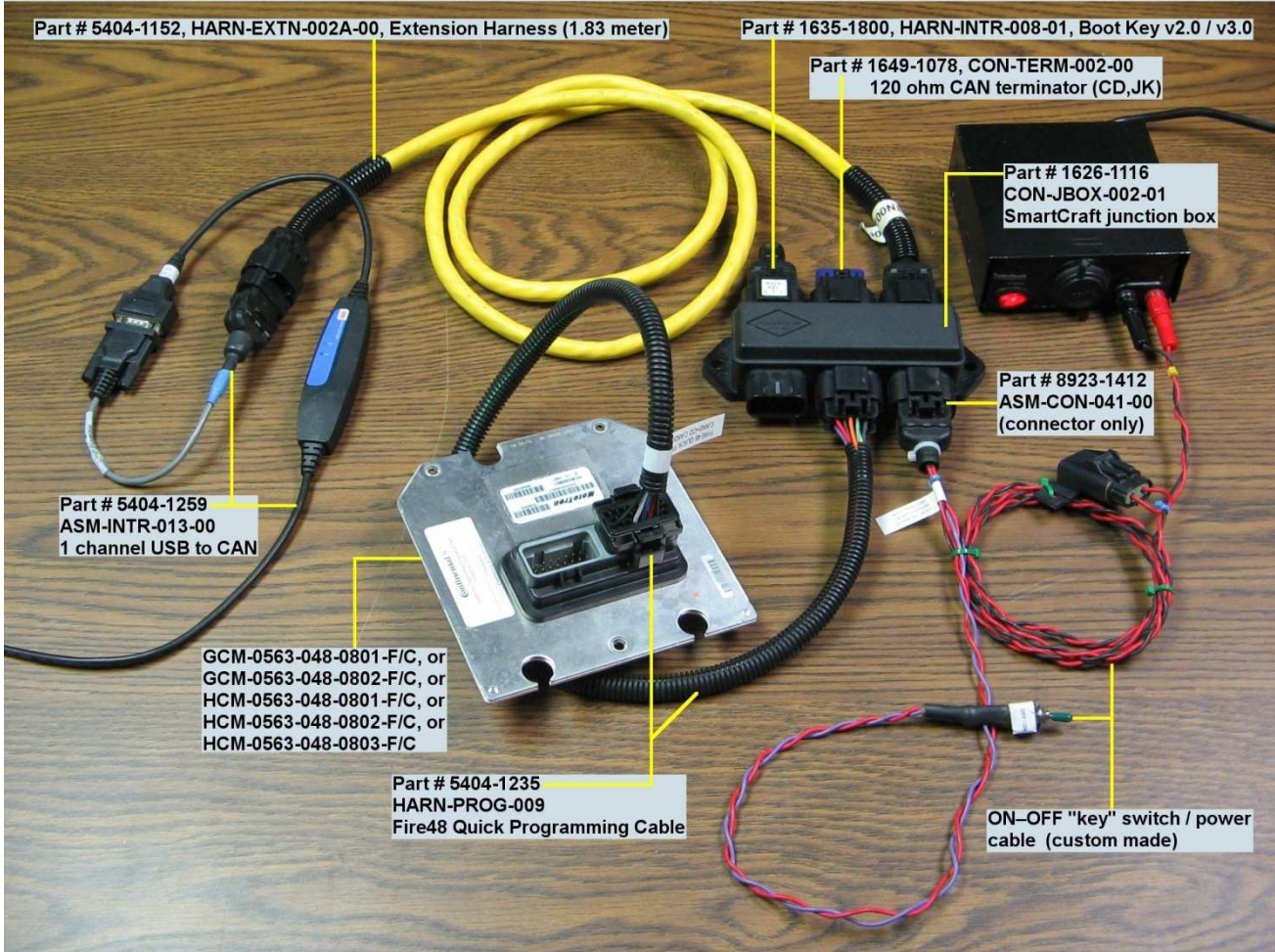


SPECIAL PARTS / TOOLS. The following parts are used in the procedures described in this document. Many of these parts are included in the MotoHawk Developer Kit. Additional accessory parts are available.

- | | | |
|--|----------------------|---|
| Part# 1626-1115 | CON-JBOX-001-01 | SmartCraft junction box, 10-pin, 4-way |
| Part# 1626-1116 | CON-JBOX-002-01 | SmartCraft junction box, 10-pin, 6-way |
| ● Part# 1649-1078 | CON-TERM-002-00 | CAN terminator, 120 ohm (CD,JK), blue cap |
| ● Part# 1635-1800 | HARN-INTR-008-01 | Boot Key v2.0 (or v3.0) |
| Part# 5404-1109 | HARN-ECM-004-D0 | pigtail harness (12.0 foot, 3.65 meter) for 48-pin module |
| Part# 5404-1124 | HARN-ECM-014 rev 00 | development harness, G/HCM-0563-048 (Fire48) |
| Part# 5404-1138 | HARN-ECM-022 rev 02 | Quick Prog and Boot Cable, G/HCM-0563-048 (Fire48) |
| Part# 5404-1235 | HARN-PROG-009 rev 00 | Quick Programming Cable, G/HCM-0563-048 (Fire48) |
| ● Part# 8909-1043 | ASM-CNDV-002 | Desktop Simulator |
| ● Part# 5404-1203 | HARN-INTR-024C | harness, simulator to 48 pin, G/HCM-0563-048 (Fire48) |
| Part# 8923-1402 | ASM-BBOX-048-1002 | Breakout Box for 48-pin module |
| ● Part# 5404-1259 | ASM-INTR-013-00 | Kvaser USB-to-CAN cable (1-channel) |
| Part# 5404-1252 | ASM-INTR-006-00 | Kvaser USB-to-CAN cable (2-channel) |
| ● Part# 5404-1152 | HARN-EXTN-002A-00 | extension harness (6.0 foot, 1.83 meter) "yellow cable" |
| Part# 5404-1164 | HARN-EXTN-005-01 | extension harness (0.5 foot, 0.15 meter) |
| Part# 5404-1103 | HARN-DC-004-00 | on/off "key" switch for junction box (3.0 foot, 0.91 meter) |
| Part# 5404-1105 | HARN-DC-007-00 | keyswitch with key and bezel (use with part# 5404-1190) |
| Part# 5404-1190 | HARN-INTR-016-00 | harness, keyswitch to junction box (3.0 foot, 0.91 meter) |
| Part# 8923-1407 | ASM-CON-002-00 | connector kit, 48-pin modules |
| Part# 8996-2150 | TOOL-CON-008-00 | crimper for terminals for 48/80/128-pin modules |
| Part# 8923-1412 | ASM-CON-041-00 | connector kit, SmartCraft 10 pin (female) (makes 10) |
| Part# 8996-2153 | TOOL-CON-011-00 | crimper for SmartCraft terminals (MAC TCT1028) |
| Part# 8996-2143 | TOOL-CON-001-00 | crimper (works for SmartCraft, 48/80/128-pin terminals) |
| ● Laptop computer with MotoTune and MotoServerRuntime software installed | | |

- — parts shown in picture above

Woodward MCS -- MotoTune Boot Key Programming for GCM/HCM-0563-048-08xx (Fire48 family)



Procedure 1 (BOOT KEY method): use Boot Key (v2.0 or v3.0) with Quick Programming Cable.

The Quick Programming Cable is recommended for hardboot recovery using the Boot Key. The Quick Programming Cable has only the minimum number of wires required to program the module: BATT, GROUND, KEYSW (ECUP, WAKE), STOP, CAN1H, CAN1L. Other harnesses may have missing or unexpected connections that interfere with hardboot recovery.

SmartCraft 10-pin	G/HCM-0563-048-08xx
pin A (BATT)	pin B-22 (BATT)
pin B (GROUND)	pin B-17 (DRVG)
pin E (STOP)	pin B-23 (STOP)
pin F (KEYSW/ECUP/WAKE)	pin B-08 (KEYSW)
pin J (CAN1_H)	pin B-20 (CAN1_H)
pin K (CAN1_L)	pin B-21 (CAN1_L)

Items required:

- ECU control module to be programmed – G/HCM-0563-048-08xx (Fire48)
- Boot Key (v2.0 or v3.0)
- Quick Programming Cable (Fire48) (Part# 5404-1235, HARN-PROG-009)
- ON-OFF "key" switch / power supply to connect power supply and SmartCraft junction box
- SmartCraft junction box, 10-pin, 6-way
- CAN terminator (blue cap)
- 12 Vdc (or 24 Vdc) power supply, 3 amps minimum
- Kvaser USB-to-CAN cable (1-channel or 2-channel), extension harness to SmartCraft junction box
- Laptop computer with MotoTune and MotoServerRuntime software installed

Procedure 1 (continued).

Setup:

1. Set power supply OFF. Set keyswitch OFF.
2. Connect SmartCraft junction box to power supply with ON–OFF "key" switch / power cable.
3. Connect 120-ohm CAN termination resistor (CD,JK) (blue cap) to SmartCraft junction box.
4. Connect laptop computer to SmartCraft junction box with Kvaser USB-to-CAN cable and extension harness.
5. Connect Boot Key v2.0 (or v3.0) to SmartCraft junction box.
6. Connect Quick Programming Cable to ECU module, but do not connect to SmartCraft junction box yet.**
7. Set power supply ON. Set keyswitch ON.**

Programming (step 9 must be done immediately after step 8, while MotoTune is trying to "find" ECU):

8. Start programming from MotoTune, to port location PCM-1 (CityID 11 = 0x0B), 250k baud, access level 4.
9. Connect Quick Programming Cable to SmartCraft junction box.**

MotoTune should find the module and programming should begin. If not, disconnect Quick Programming Cable from SmartCraft junction box, verify setup steps 1 to 7, then retry programming steps 8 and 9.

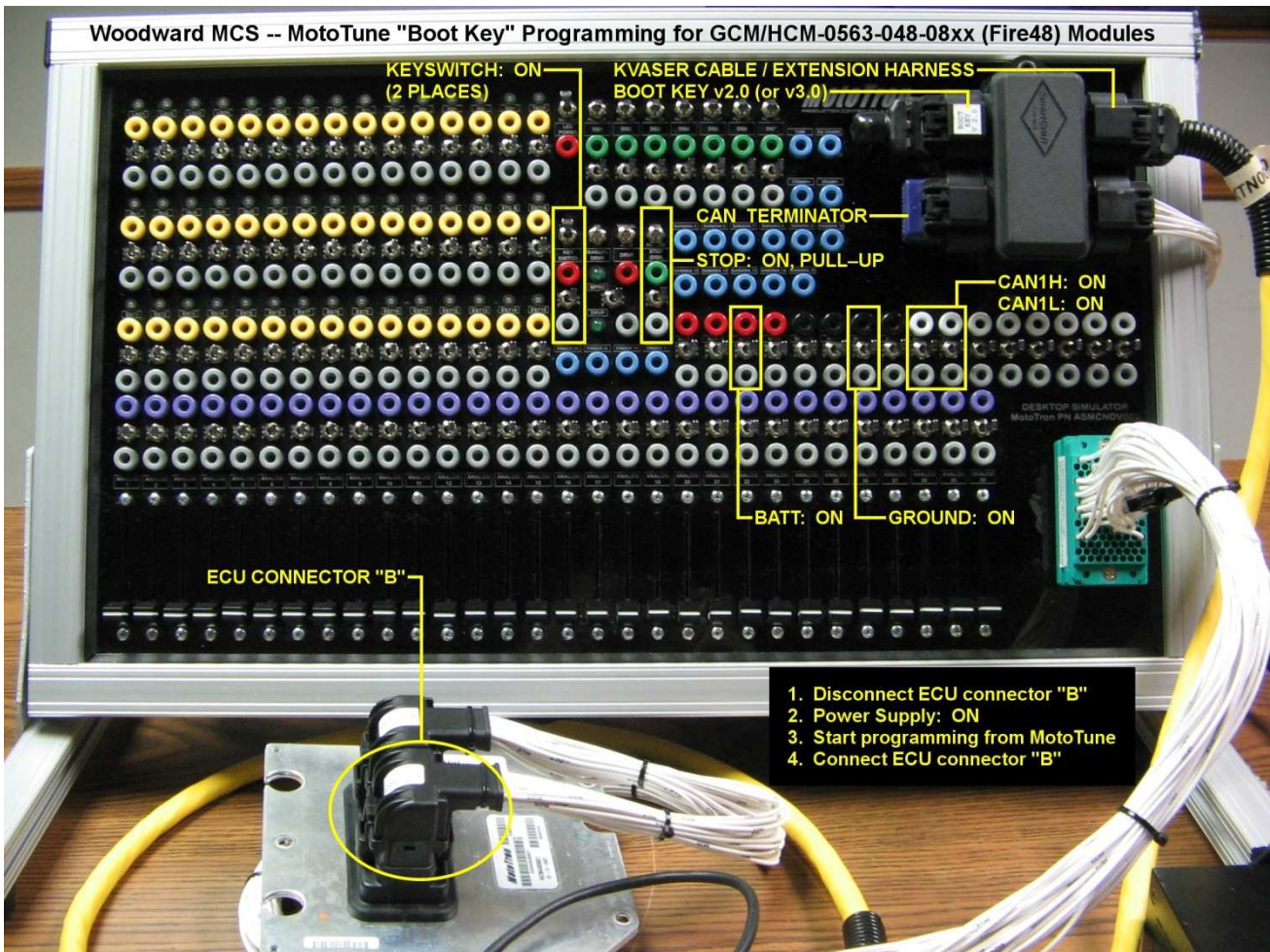
**NOTES:

At ECU control module power-up, the hardboot loader immediately begins looking for the Boot Key 555-Hz square wave input signal to the STOP pin.

If the Boot Key signal is detected, the hardboot loader waits 4 seconds for MotoTune programming instructions. If programming instructions are received properly, the module begins re-programming. Otherwise, the hardboot loader starts the previously programmed application. If the previously programmed application is damaged or corrupted (for instance, due to power interruption during previous programming cycle), the hardboot loader continues running.

For this hardboot recovery procedure, the Boot Key is connected (step 4) and powered (step 7) so that the 555-Hz square wave is generating properly, before programming starts (step 8), and before the hardboot loader starts running when the control module is connected to the SmartCraft junction box (step 9).

It is often possible first to connect the Quick Programming Cable to the SmartCraft junction box and then, after starting to program from MotoTune, turn power supply ON and keyswitch ON — that is, switch steps 7 and 9. However, this alternate sequence may not work in some cases because the Boot Key signal may not be ready when the hardboot loader checks for the 555-Hz signal.



Procedure 2 (BOOT KEY method): use Boot Key (v2.0 or v3.0) with Desktop Simulator.

To use the Desktop Simulator for hardboot recovery using BOOT KEY method, set up as described below.

Items required:

- ECU control module to be programmed – G/HCM-0563-048-08xx (Fire48)
- Boot Key (v2.0 or v3.0)
- Desktop Simulator
- Desktop Simulator to ECU control module harness
- CAN terminator (blue cap)
- 12 Vdc (or 24 Vdc) power supply, 3 amps minimum
- Kvaser USB-to-CAN cable (1-channel or 2-channel), extension harness to SmartCraft junction box
- Laptop computer with MotoTune and MotoServerRuntime software installed

Setup:

1. Set power supply OFF.
2. Connect Desktop Simulator power wire (red) and ground wire (black) to power supply.
3. Connect 120-ohm CAN termination resistor (CD,JK) (blue cap) to SmartCraft junction box (10-pin, 4-way) on Desktop Simulator.
4. Connect laptop computer to SmartCraft junction box with Kvaser USB-to-CAN cable and extension harness.
5. Connect Boot Key v2.0 (or v3.0) to SmartCraft junction box (10-pin, 4-way) on Desktop Simulator.

Procedure 2 (continued).

6. Connect Desktop Simulator – ECU harness to Desktop Simulator and to ECU module connector A, but do not connect to ECU module connector B yet.
7. Set up Desktop Simulator (power supply is OFF from step 1):
 - Set BATT ON.
 - Set KEYSW ON (2 places).
 - Set GROUND ON.
 - Set CAN1H ON.
 - Set CAN1L ON.
 - Set STOP ON and PULL-UP.
8. Set power supply ON.

Programming (step 10 must be done immediately after step 9, while MotoTune is trying to "find" ECU):

9. Start programming from MotoTune, to port location PCM-1 (CityID 11 = 0x0B), 250k baud, access level 4.
10. Connect Desktop Simulator – ECU harness to ECU module connector B.

MotoTune should find the module and programming should begin. If not, disconnect Quick Programming Cable from SmartCraft junction box, verify setup steps 1 to 8, then retry programming steps 9 and 10.

Procedure 3 (BOOT CABLE method): use Boot Cable.

The Quick Programming and Boot Cable (Part# 5404-1138) is similar to the Quick Programming Cable (Part# 5404-1235), but has additional wiring in the harness to set the analog inputs to the specified "hardboot" "pull-up" / "pull-down" configuration. The STOP pin is not connected, so this cable will not work with the Boot Key.

SmartCraft 10-pin		G/HCM-0563-048-08xx
pin B (GROUND)		pin B-17 (DRVG)
pin F (KEYSW/ECUP/WAKE)	to all of	pin B-08 (KEYSW)
		+ pin B-22 (BATT)
pin J (CAN1_H)		pin B-20 (CAN1_H)
pin K (CAN1_L)		pin B-21 (CAN1_L)

Additional connections to force hardboot mode (harness switch in "BOOT" position):

G/HCM-0563-048-08xx		G/HCM-0563-048-08xx
pin B-24 (XDRP) (thru "BOOT" switch)	to all of	pin B-03 (AN2)
		+ pin B-11 (AN4)
		+ pin A-11 (AN6)
		+ pin A-09 (AN7)
		+ pin A-12 (AN8)
		+ pin B-09 (AN9)
		+ pin B-12 (AN10)
		+ pin B-18 (AN11)
		+ pin B-19 (AN12)
pin B-01 (XDRG)	to all of	pin B-02 (AN1)
		+ pin B-10 (AN3)
		+ pin A-10 (AN5)

Items required:

- ECU control module to be programmed – G/HCM-0563-048-08xx (Fire48)
- Boot Cable – Quick Programming and Boot Cable (Fire48) (Part# 5404-1138, HARN-ECM-022 rev 01 +)
- ON–OFF "key" switch / power cable to connect power supply and SmartCraft junction box
- SmartCraft junction box, 10-pin, 6-way
- CAN terminator (blue cap)
- 12 Vdc (or 24 Vdc) power supply, 3 amps minimum
- Kvaser USB-to-CAN cable (1-channel or 2-channel), extension harness to SmartCraft junction box
- Laptop computer with MotoTune and MotoServerRuntime software installed

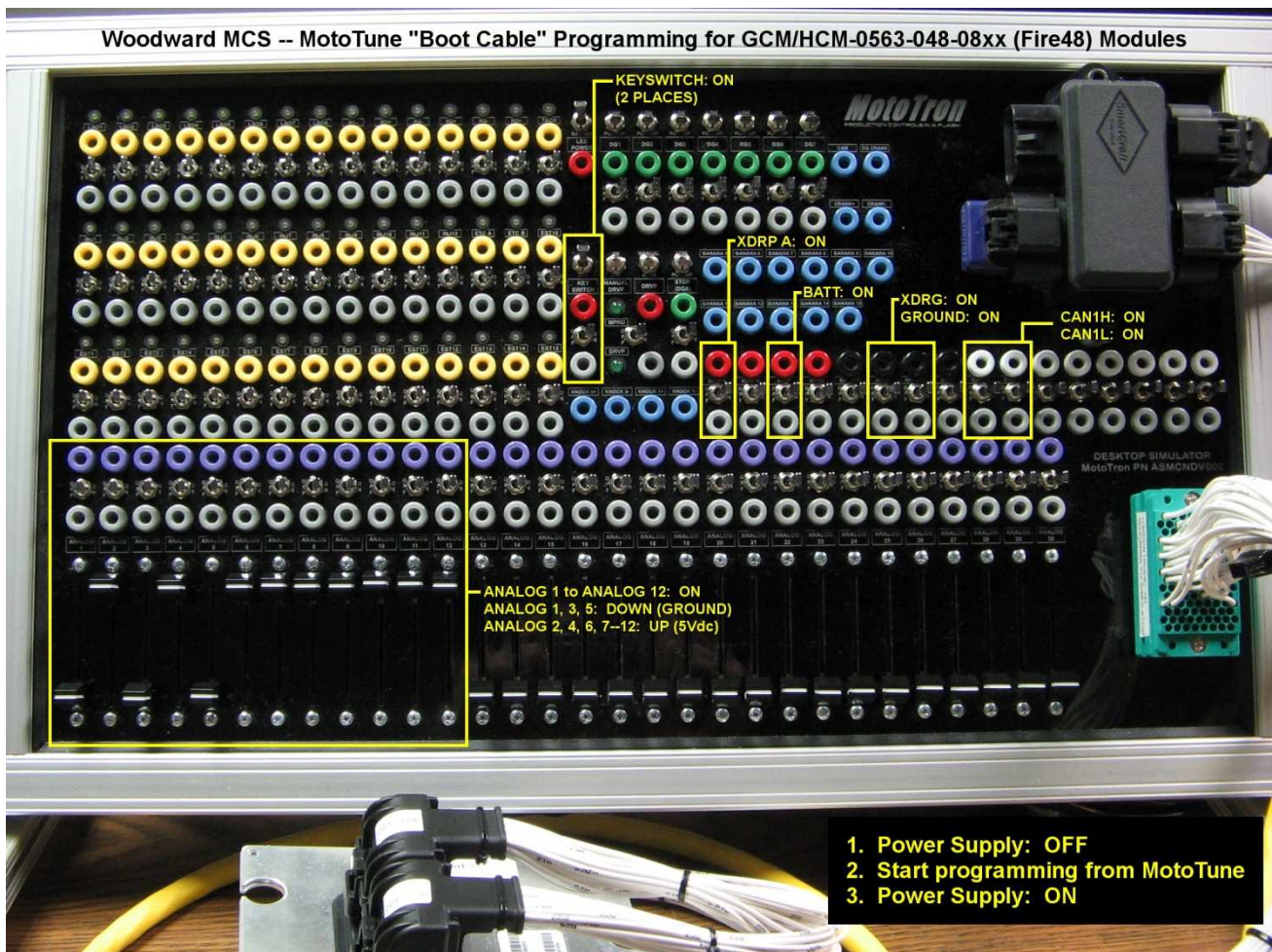
Setup:

1. Set power supply OFF. Set keyswitch OFF.
2. Connect SmartCraft junction box to power supply with ON–OFF "key" switch / power cable.
3. Connect 120-ohm CAN termination resistor (CD,JK) (blue cap) to SmartCraft junction box.
4. Connect laptop computer to SmartCraft junction box with Kvaser USB-to-CAN cable and extension harness.
5. Connect Boot Cable to ECU module and to SmartCraft junction box. Set "BOOT" switch ON.

Programming (step 7 must be done immediately after step 6, while MotoTune is trying to "find" ECU):

6. Start programming from MotoTune, to port location PCM-1 (CityID 11 = 0x0B), 250k baud, access level 4.
7. Set power supply ON. Set keyswitch ON.

MotoTune should find the module and programming should begin. If not, verify setup steps 1 to 5, then retry programming steps 6 and 7.



Procedure 4 (BOOT CABLE method): set Desktop Simulator analog inputs to Boot Cable configuration

To use the Desktop Simulator for hardboot recovery using BOOT CABLE method, set the analog input "slider" potentiometer inputs to match "boot cable" settings, as described below.

Items required:

- ECU control module to be programmed – G/HCM-0563-048-08xx (Fire48)
- Desktop Simulator
- Desktop Simulator to ECU control module harness
- CAN terminator (blue cap)
- 12 Vdc (or 24 Vdc) power supply, 3 amps minimum
- Kvaser USB-to-CAN cable (1-channel or 2-channel), extension harness to SmartCraft junction box
- Laptop computer with MotoTune and MotoServerRuntime software installed

Setup:

1. Set power supply OFF.
2. Connect Desktop Simulator power wire (red) and ground wire (black) to power supply.
3. Connect 120-ohm CAN termination resistor (CD,JK) (blue cap) to SmartCraft junction box (10-pin, 4-way) on Desktop Simulator.
4. Connect laptop computer to SmartCraft junction box with Kvaser USB-to-CAN cable and extension harness.
5. Connect Desktop Simulator – ECU harness to Desktop Simulator and to ECU module (both connectors).

Procedure 4 (continued).

6. Set up Desktop Simulator (power supply is OFF from step 1):

- Set BATT ON.**
- Set KEYSW ON (2 places).**
- Set GROUND ON.
- Set CAN1H ON.
- Set CAN1L ON.
- Set XDRP_A ON.
- Set XDRG ON.
- Set analog inputs 1 through 12 ON.
- Set analog input sliders DOWN for: 1, 3, 5.
- Set analog input sliders UP for: 2, 4, 6, 7, 8, 9, 10, 11, 12.

Programming (step 8 must be done immediately after step 7, while MotoTune is trying to "find" ECU):

7. Start programming from MotoTune, to port location PCM-1 (CityID 11 = 0x0B), 250k baud, access level 4.
8. Set power supply ON.**

MotoTune should find the module and programming should begin. If not, verify setup steps 1 to 6, then retry programming steps 7 and 8.

After Programming:

9. Change settings for analog input sliders. Otherwise, the ECU module will re-enter hardboot mode at next power-up.
 - Set analog input sliders DOWN for: 2, 4, 6, 7, 8, 9, 10, 11, 12.

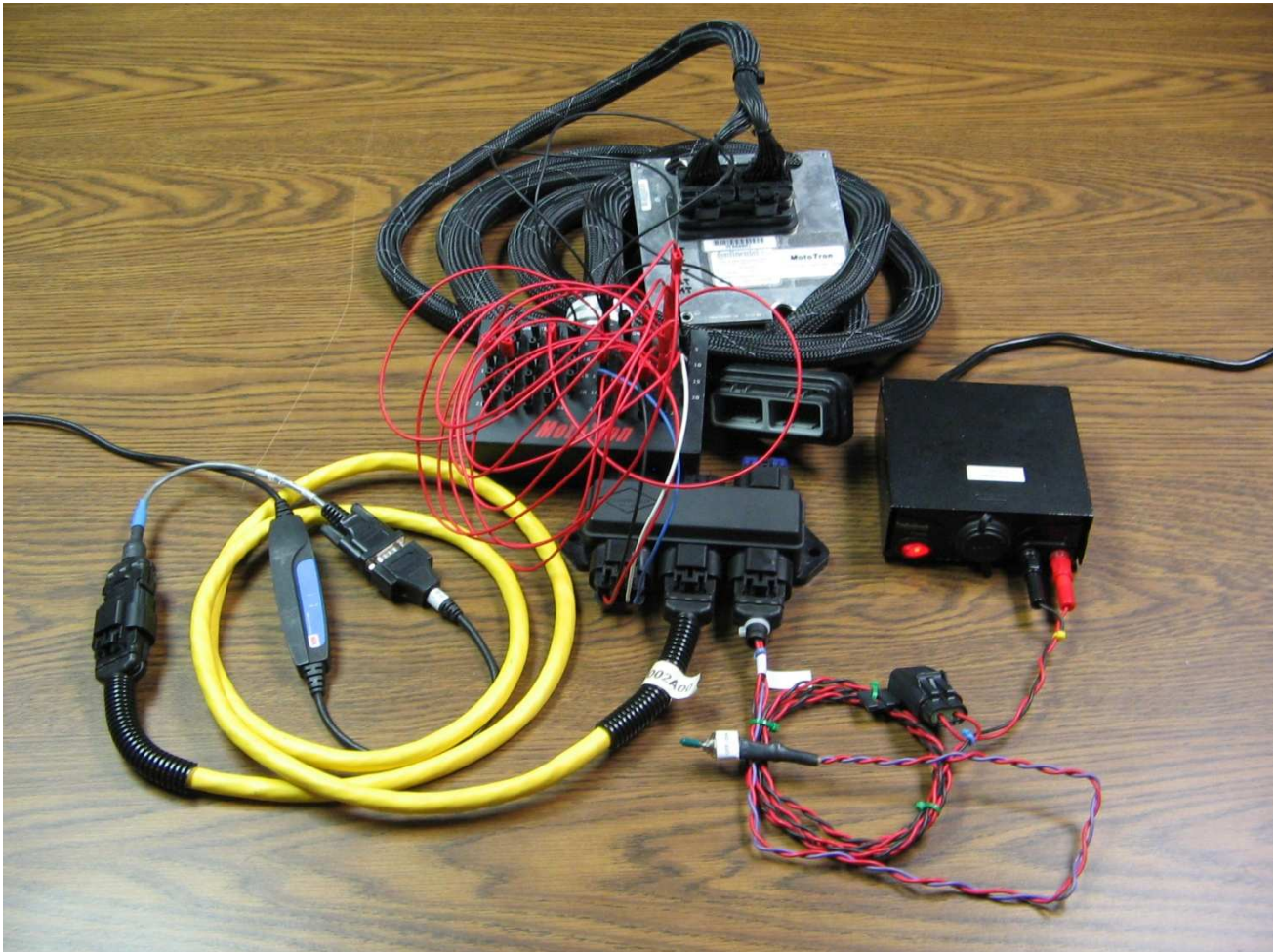
**NOTES:

The Fire48 family of ECU modules requires both BATT and KEYSW to be set ON for the module to power up.

Because the Fire48 family of ECU modules uses "controlled shutdown," both BATT and KEYSW must be disconnected for the module to be completely powered down. When BATT is connected and KEYSW is OFF, the application code in the module may still be running, depending on its shutdown algorithm.

By using the power supply to set power ON / OFF, power is provided to / removed from both BATT and KEYSW at the same time.

After the Desktop Simulator is set up properly, the BATT and KEYSW switches may be used to set power ON or OFF for hardboot recovery (BOOT CABLE method).



Procedure 5 (BOOT CABLE method): set Breakout Box to Boot Cable configuration.

The Breakout Box may be used for hardboot recovery (BOOT CABLE method) by connecting the analog inputs to match Boot Cable settings for the specified "hardboot" "pull-up" / "pull-down" configuration.

<u>SmartCraft 10-pin</u>	<u>Breakout Box</u>
pin B (GROUND)	pin B-17 (DRVG)
pin F (KEYSW/ECUP/WAKE)	to all of pin B-08 (KEYSW)
	+ pin B-22 (BATT)
pin J (CAN1_H)	pin B-20 (CAN1_H)
pin K (CAN1_L)	pin B-21 (CAN1_L)

Additional connections to force hardboot mode (harness switch in "BOOT" position):

<u>Breakout Box</u>	<u>Breakout Box</u>
pin B-24 (XDRP) (thru "BOOT" switch)	to all of pin B-03 (AN2)
	+ pin B-11 (AN4)
	+ pin A-11 (AN6)
	+ pin A-09 (AN7)
	+ pin A-12 (AN8)
	+ pin B-09 (AN9)
	+ pin B-12 (AN10)
	+ pin B-18 (AN11)
	+ pin B-19 (AN12)
pin B-01 (XDRG)	to all of pin B-02 (AN1)
	+ pin B-10 (AN3)
	+ pin A-10 (AN5)

Procedure 5 (continued).

Items required:

- ECU control module to be programmed – G/HCM-0563-048-08xx (Fire48)
- Breakout Box with jumper wires (need extra jumper wires and SmartCraft 10-pin junction box connector)
- ON–OFF "key" switch / power cable to connect power supply and SmartCraft junction box
- SmartCraft junction box, 10-pin, 6-way
- CAN terminator (blue cap)
- 12 Vdc (or 24 Vdc) power supply, 3 amps minimum
- Kvaser USB-to-CAN cable (1-channel or 2-channel), extension harness to SmartCraft junction box
- Laptop computer with MotoTune and MotoServerRuntime software installed

Setup:

1. Set power supply OFF. Set keyswitch OFF.
2. Connect SmartCraft junction box to power supply with ON–OFF "key" switch / power cable.
3. Connect 120-ohm CAN termination resistor (CD,JK) (blue cap) to SmartCraft junction box.
4. Connect laptop computer to SmartCraft junction box with Kvaser USB-to-CAN cable and extension harness.
5. Connect Breakout Box to ECU module.
6. Connect Breakout Box to SmartCraft junction box according to table above, using jumper wires and a SmartCraft 10-pin female connector (Part# 8923-1412, ASM-CON-041-00).
7. Connect Breakout Box pins for analog input pull-up to XDRP / pull-down to XDRG according to table above, using jumper wires.

Programming (step 9 must be done immediately after step 8, while MotoTune is trying to "find" ECU):

8. Start programming from MotoTune, to port location PCM-1 (CityID 11 = 0x0B), 250k baud, access level 4.
9. Set power supply ON. Set keyswitch ON.

MotoTune should find the module and programming should begin. If not, verify setup steps 1 to 7, then retry programming steps 8 and 9.

After Programming:

10. Disconnect jumpers XDRP (B-24) and XDRG (B-01) on Breakout Box pins for analog input pull-up / pull-down. Otherwise, the ECU module will re-enter hardboot mode at next power-up.

END OF DOCUMENT.