
Seismic Source
RTM
WDC
Manual

Weight Drop Controller
Universal Encoder setup for WDC
Radio Trigger Module

Revision History:

Rev 9	December 2013	KEB
Rev 8	September 25, 2012	KEB
Rev 7	May 11, 2012	KEB
Rev 6	August 13, 2009	KEB
Rev 5	Aug 08, 2009	VVM
Rev 4	November 28, 2006	VVM
Rev 3	August 01, 2006	VVM
Rev 2	July 11, 2006	VVM
Rev 1	Feb 9, 2006	VVM

Contents

Introduction

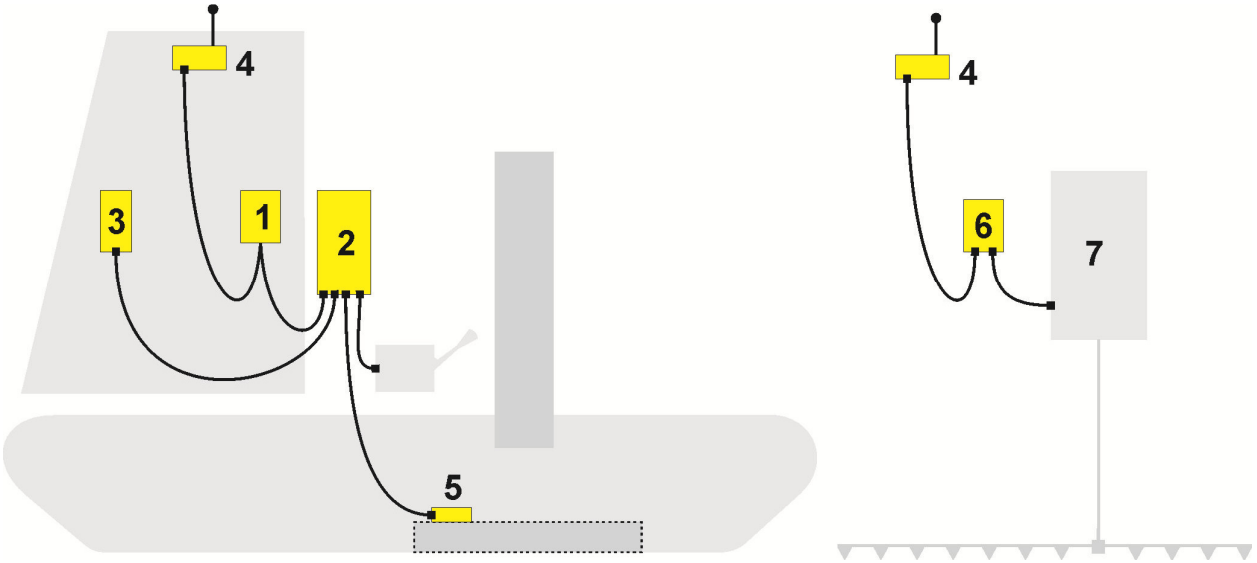
This document contains operator manuals for the Radio Trigger Module (RTM) and Weight Drop Controller (WDC) and describes WDC setup for Universal Encoder (UE) and Source Control program.

The manual gives description of the module and step-by-step module setup and operation.

Both the RTM and WDC units are needed for complete Weight Drop seismic system. The RTM provides radio interface and timing, while WDC interfaces RTM to hydraulic system.

The description of the Weigh Drop unit as a whole is based on an accelerated hammer unit. While all hammer units are similar in general, some small variations could apply to each particular build. For example, trailer based hammer units may not have the Base Plate Down limit switch installed and etc. Those details must be considered during the electronics installation and operation.

Accelerated Weight Drop System Component Overview



Basic system components:

1. RTM
2. WDC
3. Remote Control
4. VHF Radio
5. Hammer Switch
6. UE, RTM Encoder or Boom Box Encoder
7. Any Seismic Recording System

Optional components:

- GPS
- WDC Proximity sensors
- Recording system cable

Weight Drop Controller Description

The Weight Drop Controller (WDC) consists of the following parts:

- Control panel (WDC electronic enclosure)
- Connecting cables (to RTM, Remote, valves, hammer switch)
- Hammer switch and Proximity switches (optional)

List of limit (proximity) and pressure switches use for different models of AWDs

AWD model:	UP Hammer	DN Hammer	Tilt	Base Plate	WDC electronics version
XLR8	Yes	Yes	-	Yes	WDC Ver 4 – 7 or later
Digipulse	Yes	Yes	-	Yes	WDC Ver 4 – 5
Vectapulse	Yes	Yes	Yes	Yes	WDC Ver 4 – 5
Auto-Fire	-	-	-	Option	WDC AutoFire Ver 3 or later

Limit switches consist of the following:

- Hammer Up limit switch – active when hammer reaches upper position. Active state signal must be high (+12V) on the switch output for the electronics to operate properly.
- Hammer Down limit switch – active when hammer assembly is in armed/down position. Active state signal must be high (+12V) on the switch output for the electronics to operate properly.
- Tilt switch – active when hammer assembly is vertical, to allow rotate function.
- Base Plate limit or pressure switch – active when B. Plate is on the ground. When active, switch is closed (conductive).
- Hammer switch – active when hammer hits the B. Plate. Active state signal must be Low (0V) on the switch output for the electronics to operate properly.

The Radio Trigger Module (RTM) can be mounted inside the truck cabin and provides following functions:

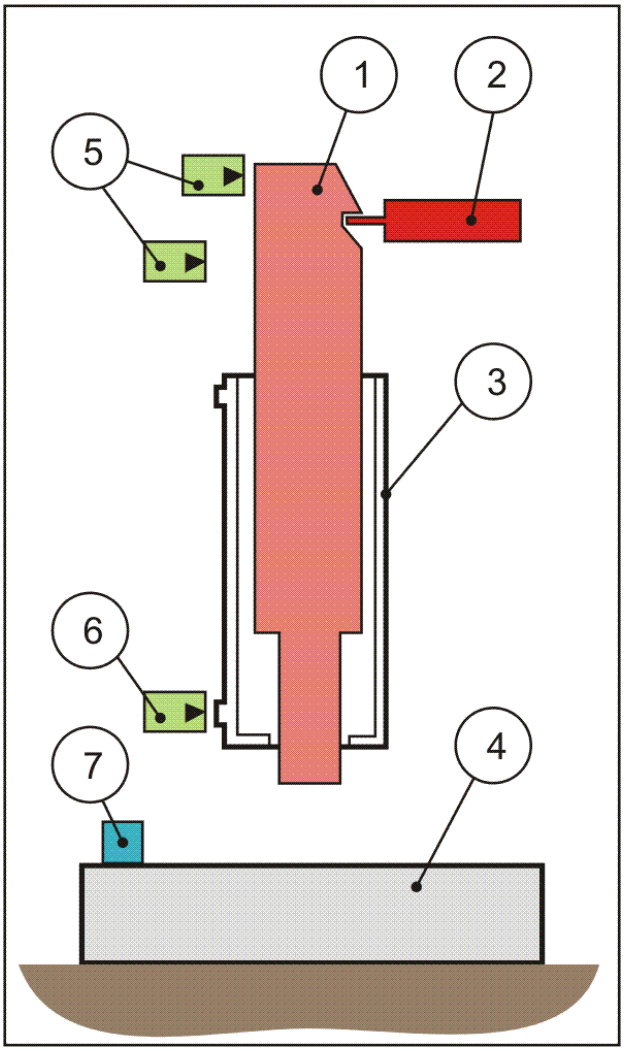
- Arms WDC by providing Arm pulse
- Arms Recorder, by providing Start signal and position of the unit
- Fires AWD and detects the hammer Hit signal
- Generates Confirmed Time Break signal to Recorder
- Continues shooting cycle until pre-programmed number of shots is reached

The WDC is mounted outside the truck cabin and provides following functions:

- Converts all RTM signals to hydraulic functions
- Provides arming timing and monitoring proximity switches

WDC Components for AWD Models: XLR8, Digipulse and Vectapulse.

The main characteristic of these AWD models is the hammer is latched in the top position when unit is ready to fire.
Seismic Source WDC Ver 4 - 7 or later can operate the hammer unit consisting of the parts shown below:



1. Hammer
2. Latch – Release Mechanism
3. Hammer Cocking Cylinder
4. Base Plate *
5. UP Proximity Switch **
6. DOWN Proximity Switch
7. Hammer Switch

Note:
* The Base Plate Proximity or Pressure Switch is optional and needed to prevent mechanical damage of the unit.

** There are two possible locations for the UP Proximity Switch shown. The WDC requires only one of them.
The preferred location is by the top of the hammer. The lower location detects cylinder in the top position.

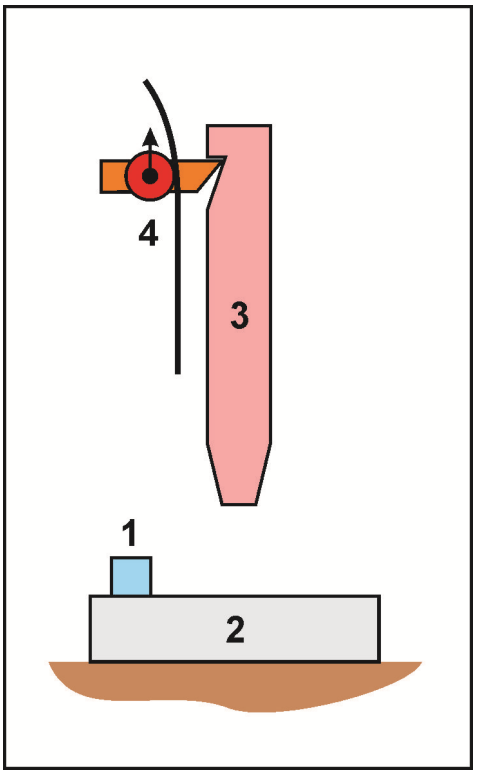
The hammer unit with WDC operates the following way:

1. **Arming the hammer**
   The hammer (1) is driven by WDC servo system in upward direction until it reaches the top and latches by latch (2). At the same time the UP Proximity Switch is switched ON and the WDC turns Off upward drive and turns ON downward servo drive to lower the hammer cylinder (3). The cylinder (3) reaches the bottom and turns ON the DOWN Proximity Switch (6). The WDC stops the hammer servo drive.
2. **Firing the hammer**
   The WDC checks condition of the UP, DOWN and Base Plate Proximity Switches and generated Ready command to the Remote Trigger Module (RTM). The RTM issues the FIRE

command, which drives the servo to release the Latch (2). The RTM is reading the Hammer Switch (7) and when it goes LOW, generates the Confirmed Time Break (CTB). In case of the switch (7) failure, the time-out occurs and the RTM-WDC system will try to arm the hammer again, depends on the mode of operation.

WDC Components for AWD models: AUTO-FIRE (Rapid Fire).

The main characteristic of this AWD model is the hammer is never latched, but raised to be released in the top position. Hammer and cocking hook is down when unit is ready to fire cycle.
Seismic Source WDC AUTO-FIRE Ver 3 or later can operate the hammer unit consisting of the parts shown below:



1. Hammer switch
2. Base Plate
3. Hammer
4. Hammer cocking mechanism

AUTO-FIRE Ver. 3.3 and Older

The hammer unit with WDC AUTO-FIRE operates the following way:

1. **Arming the hammer**
   The hammer (3) is assumed to be in the down position. After checking BP position, WDC is driving cocking mechanism (4) down for selected amount of time and only then generated Ready signal. RTM sends Ready radio message to arm recorder and provides position of the unit.
2. **Firing the hammer**
   RTM generates Fire pulse on manual or radio request. WDC starts driving cocking cylinder (4) for selected amount of time and hammer is released. The RTM is reading the Hammer Switch (1) and when it goes LOW, generates the Confirmed Time Break (CTB). In case of the

Hammer switch (1) failure, the time-out occurs and the RTM-WDC system will try to arm the hammer again, depends on the mode of operation.

AUTO-FIRE Ver. 5 and Newer

The hammer unit with WDC AUTO-FIRE operates the following way:

1. **Arming the hammer**
   The hammer (3) is assumed to be in the down position. The WDC waits for an Arm command from the Arm/Fire switch then checks for the BP position to be down. After both conditions are met then the WDC drives the cocking mechanism (4) down for selected amount of time. Every ½ second the BP position is checked to make sure to keep arming the hammer. After hammer is cocked the Ready signal is set. RTM sends Ready radio message to arm recorder and provides position of the unit.
2. **Firing the hammer**
   RTM generates Fire pulse on manual or radio request. WDC starts driving cocking cylinder (4) for selected amount of time and hammer is released. Every ½ second the BP position is checked to make sure to keep driving the cocking cylinder (4). The RTM is reading the Hammer Switch (1) and when it goes LOW, generates the Confirmed Time Break (CTB). In case of the Hammer switch (1) failure, the time-out occurs and the RTM-WDC system will try to arm the hammer again, depends on the mode of operation.

About the proximity switches

The proximity switch selection will depend on the mechanical constraints of the system and that will define the size and the type of the switch.

The Seismic Source WDC requires the UP, DOWN and B.P. switches must be switched ON when active. This will generate +12V output on the switch when active. In other words, proximity switch function can be described as Normally Open (NO).

Most of the proximity switches have three-wire interface (Power, Output, and Ground).

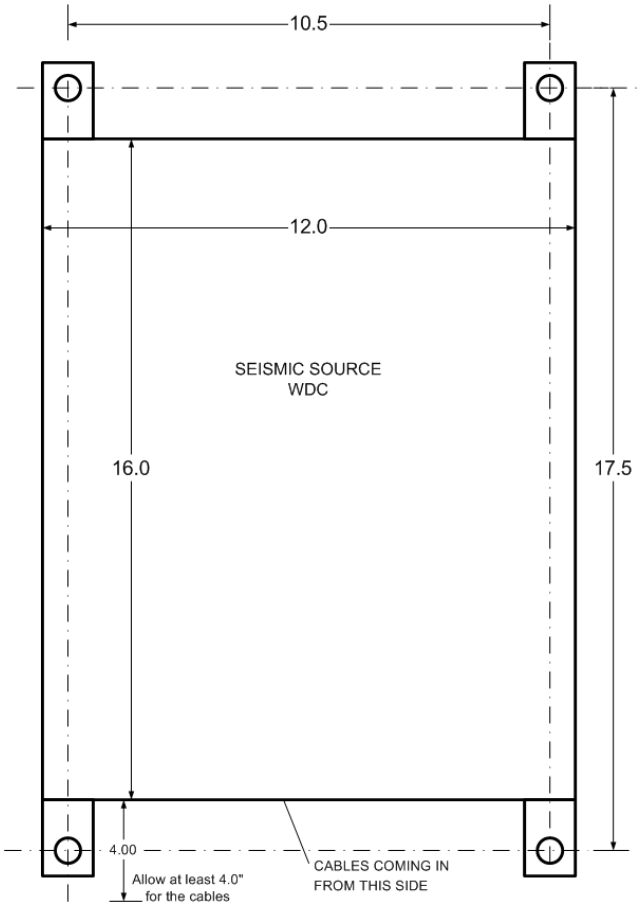
The hydraulic system control

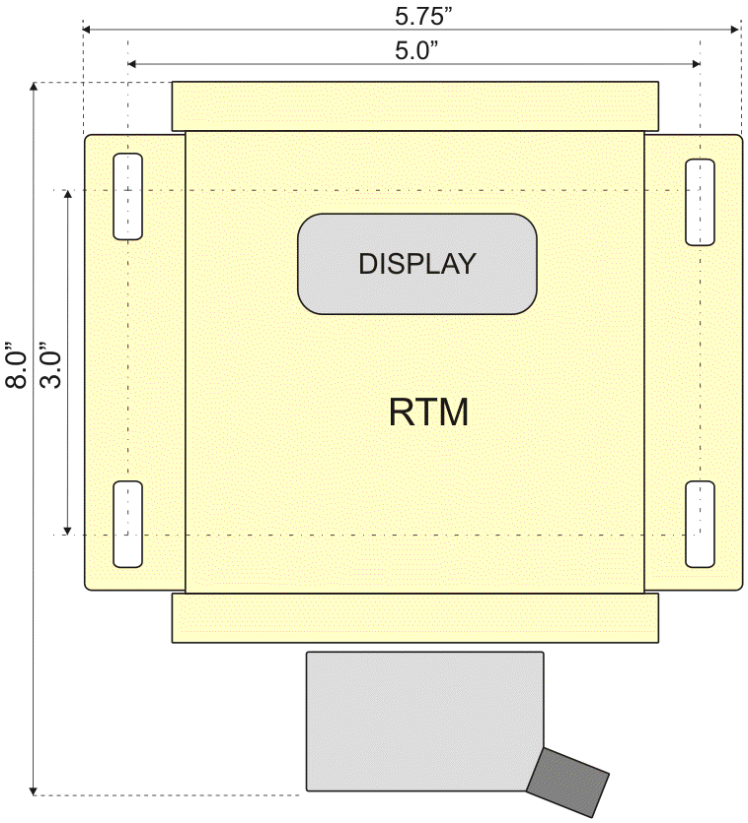
The WDC provides following +12V signals to the hydraulic valves:
1. Tilt UP and DOWN.
2. Base Plate UP and DOWN
3. Hammer UP and DOWN
4. Fire UP and DOWN (Release and Latch)
5. Rotate UP and DOWN (Left and Right) - optional

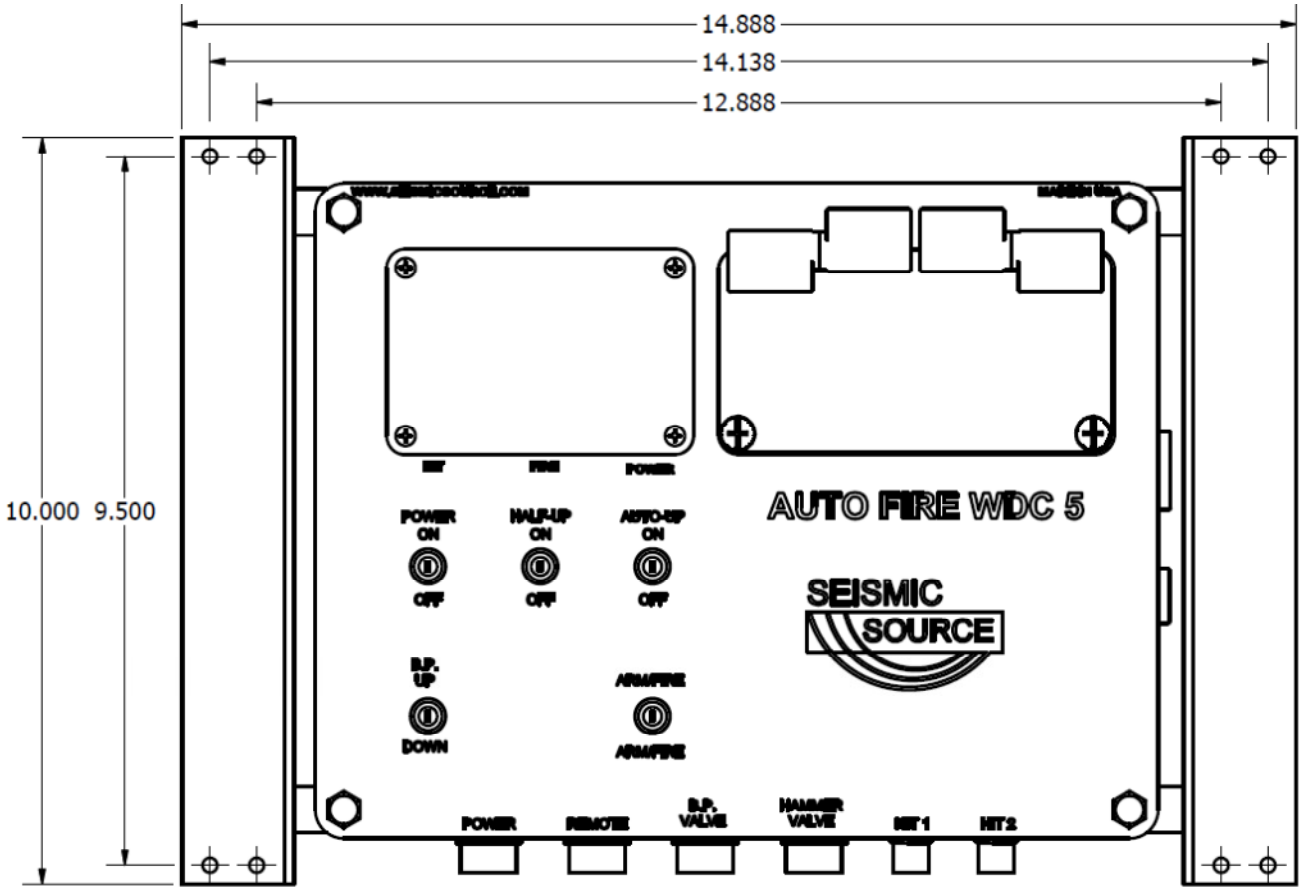
WDC and RTM Mounting Hole Dimensions.

The standard WDC and RTM dimensions are shown below. WDC and RTM are mounted on 4 shock absorbers (supplied with WDC and RTM). The truck or trailer frame must have 4-drilled holes for ½

inch bolt. The dimensions for the holes locations are also shown below for WDC and RTM prior to AUTO-FIRE Ver. 5. The AUTO-FIRE Ver. 5 is following the WDC and RTM dimensions.

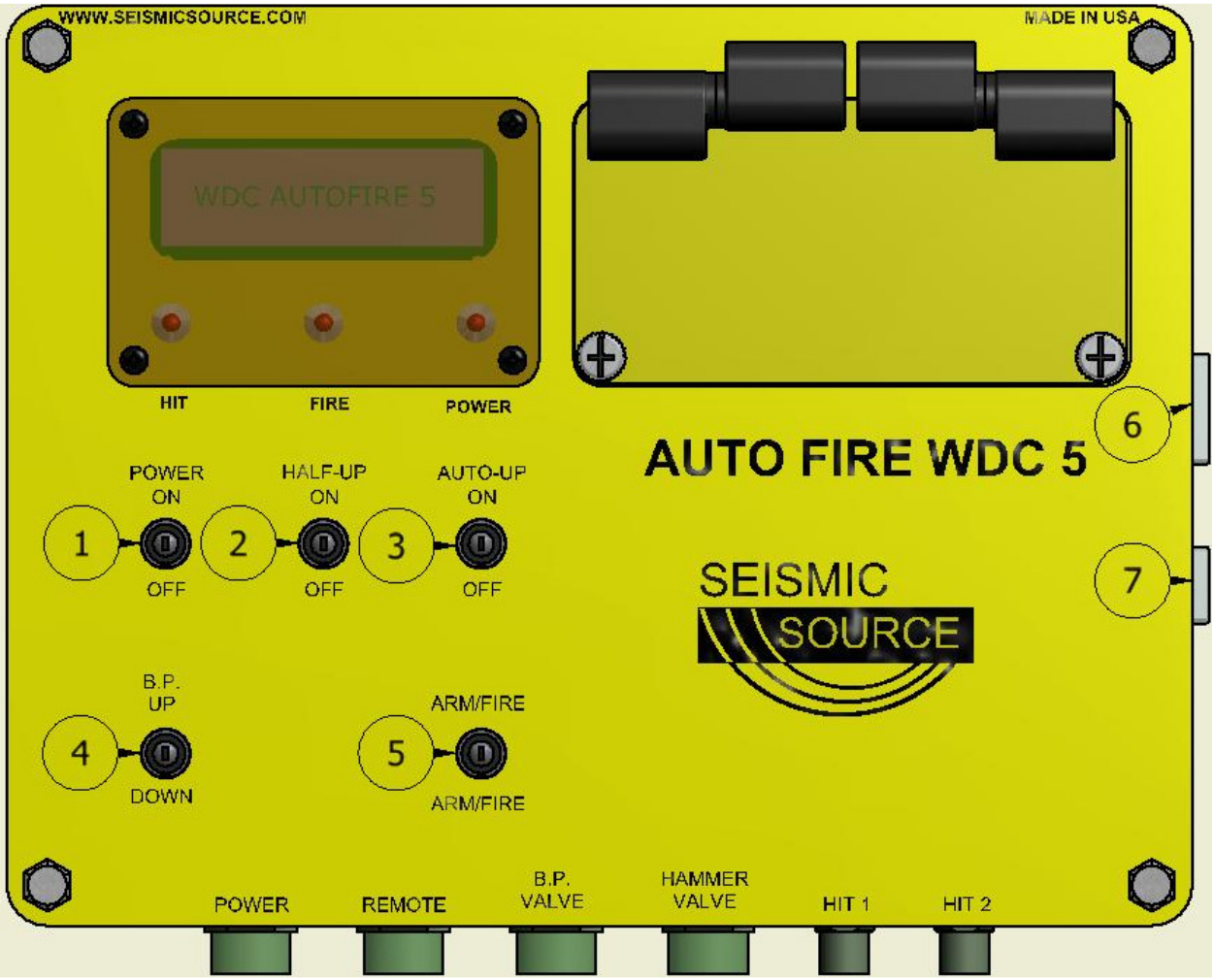



5.75”
5.0”
8.0”
3.0”
DISPLAY
RTM



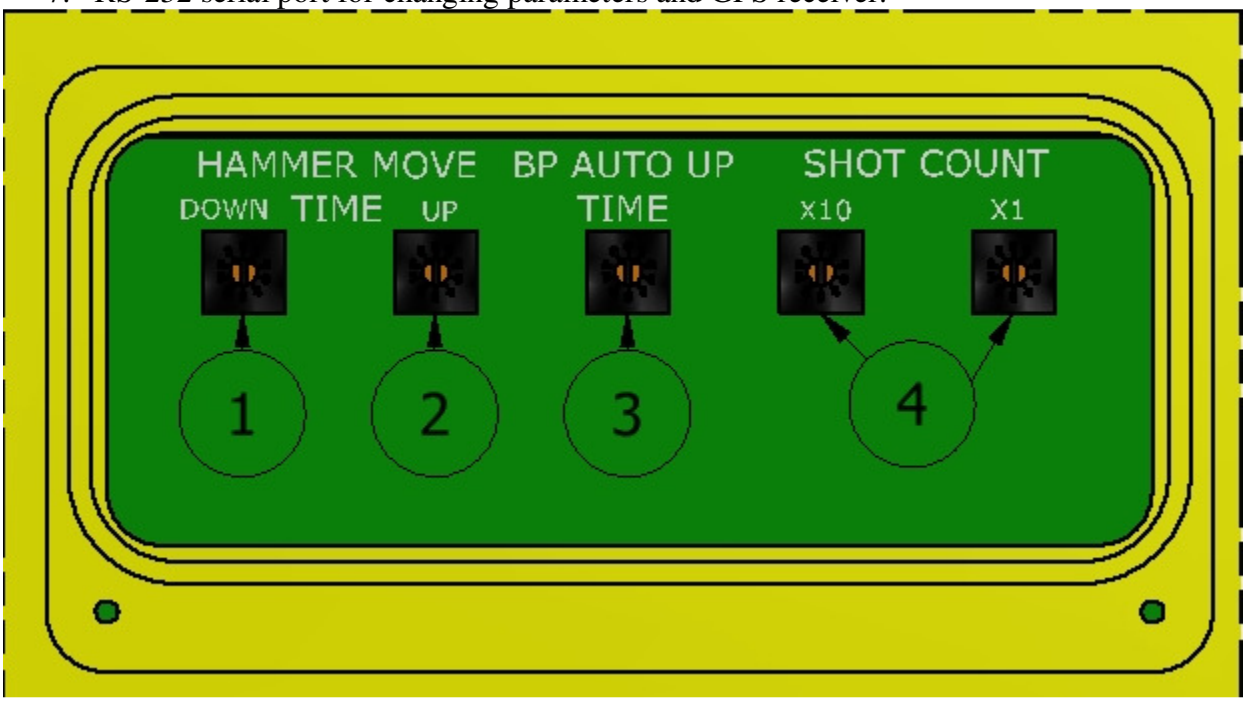
WDC AUTOFIRE 5 MOUNTING DIMENSIONS

WDC AUTO-FIRE Ver. 5 Control Panel and Remote



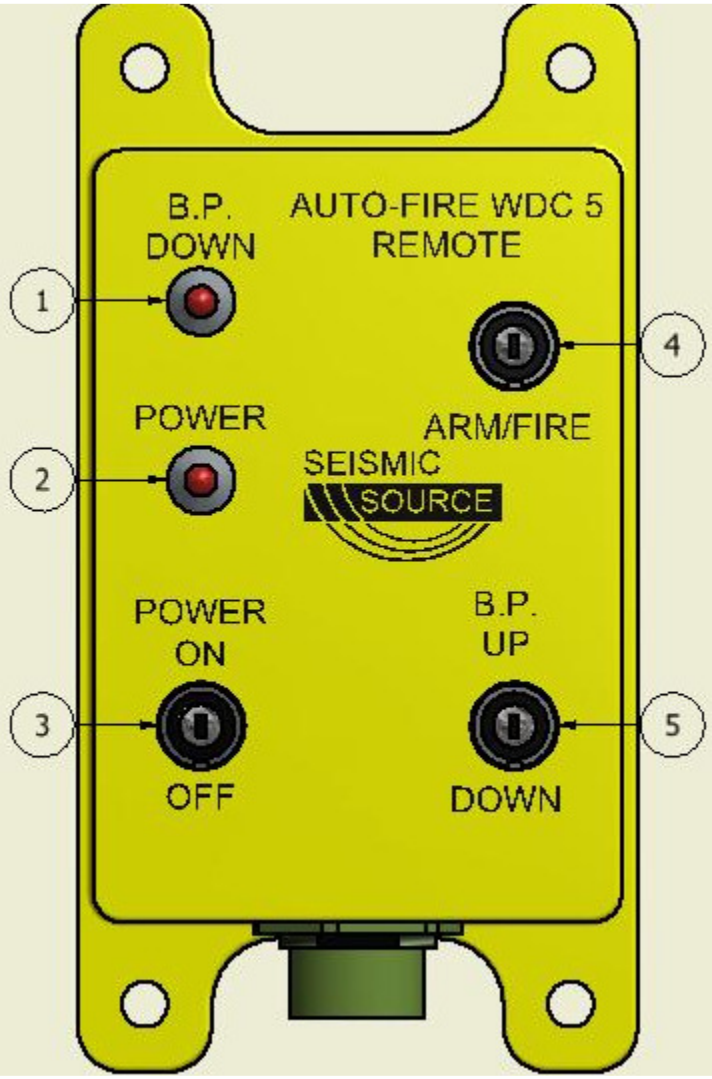
1. Power switch.
2. Half-Up. After all hits are completed the BP is raised for timed amount on BP AUTO-UP Time. AUTO-UP must be on. BP AUTO-UP Time is 0.5 Second increments.
3. Auto-UP. After all hits are completed the BP is raised for three seconds plus the BP AUTO-UP Time value. BP AUTO-UP Time is 0.5 Second increments.
4. Base Plate up and down. When B.P. UP is pressed during Arming or Firing the hammer will stop moving.
5. ARM/FIRE. When pressed, if the hammer is not armed then an armed command will be sent to the WDC. If the hammer is armed then the WDC will start the Fire sequence.
6. Test connector
    a. 1 – Power
    b. 2 – Ground
    c. 3 and 4 – Hammer switch
    d. 5 – Hammer UP solenoid
    e. 6 – Hammer DOWN solenoid
    f. 7 – Arm
    g. 8 – Fire

7. RS-232 serial port for changing parameters and GPS receiver.



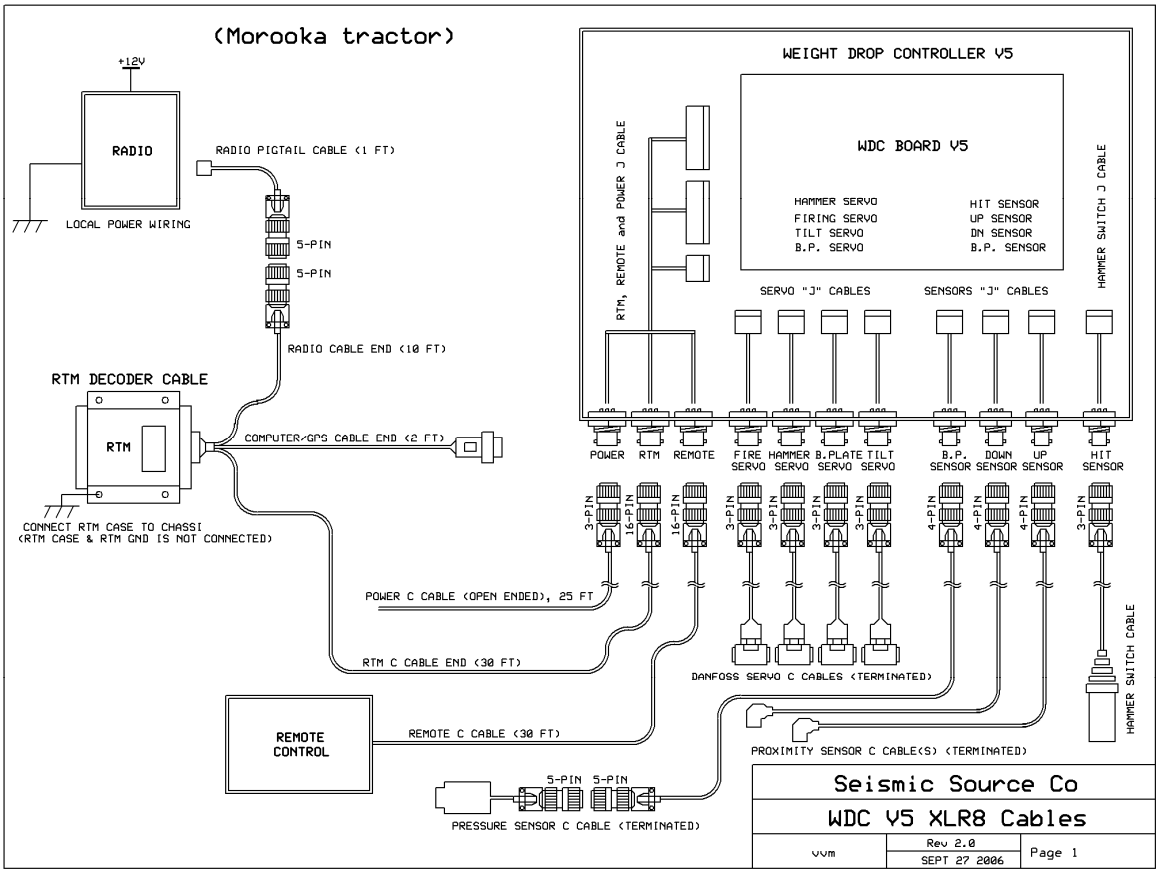
1. HAMMER MOVE TIME DOWN. Entry for amount of time the hammer will move down for arming. 0.5 Second increments.
2. HAMMER MOVE TIME UP. Entry for amount of time the hammer will move up for the Fire sequence. 0.5 Second increments.
3. BP AUTO UP TIME. Amount of time the base plate will be raised for HALF-UP. 0.5 Second increments.
4. SHOT COUNT. Entry selects the number of hits to be performed. If zero then the amount of hits programmed into the RTM by computer or over the radio are used.

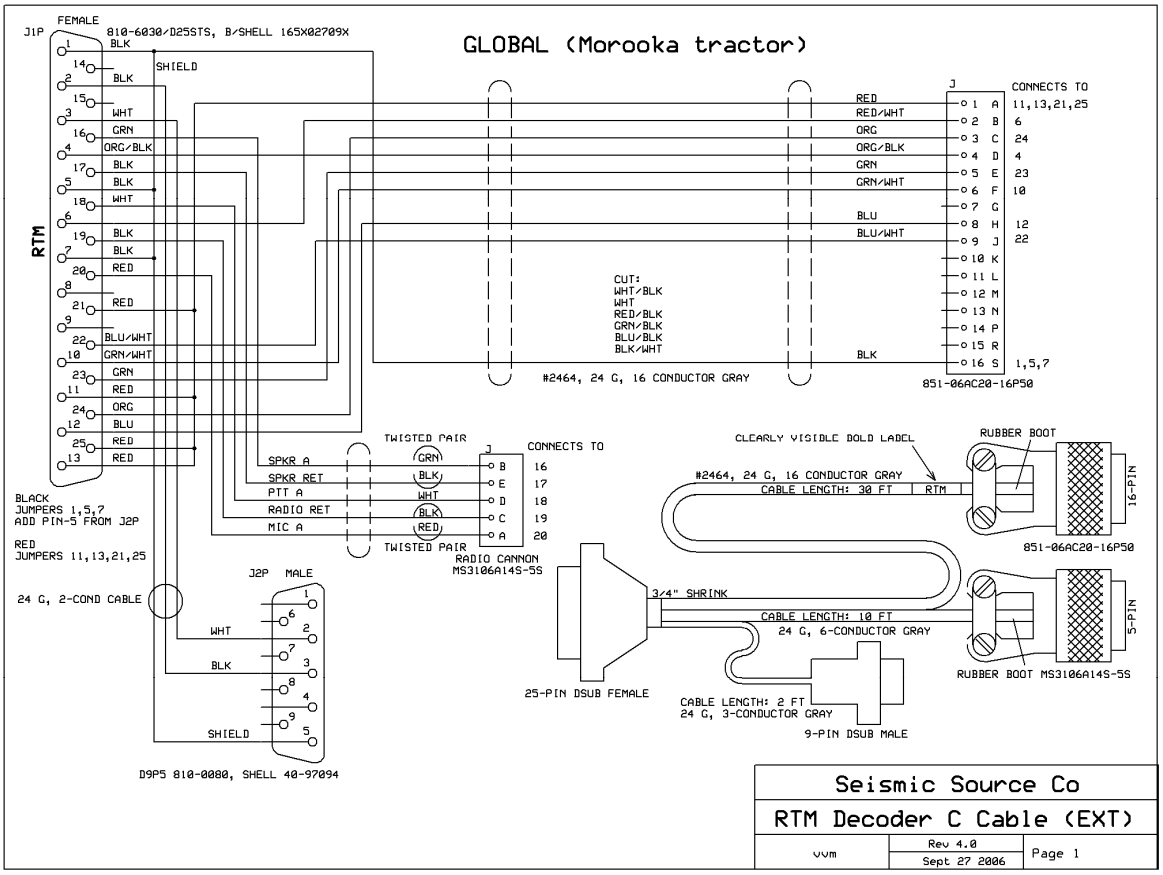
After setting the timer and shot count pots, shut the lid to keep contaminates from the circuit board.



1. B.P. DOWN. LED is on when base plate valve is set to down.
2. POWER. LED is on when power is switched on at the Remote or the Control Panel.
3. POWER. Power switch. If you want to be able to turn the power off with the Remote, turn the power off at the Control Panel.
4. ARM/FIRE. When pressed, if the hammer is not armed then an armed command will be sent to the WDC. If the hammer is armed then the WDC will start the Fire sequence.
5. Base Plate up and down. When B.P. UP is pressed during Arming or Firing the hammer will stop moving.

WDC Ver.5 Wiring Schematics




GLOBAL (Morooka tractor)
J1P FEMALE
810-6030/D25STS, B/SHELL 165X02709X
RTM
BLK
SHIELD
BLK
WHT
GRN
ORG/BLK
BLK
BLK
WHT
BLK
BLK
RED
RED
BLU/WHT
GRN/WHT
GRN
RED
ORG
BLU
RED
RED
BLACK
JUMPERS 1,5,7
ADD PIN-5 FROM J2P
RED
JUMPERS 11,13,21,25
24 G, 2-COND CABLE
J2P MALE
WHT
BLK
SHIELD
D9P5 810-0080, SHELL 40-97094
CUT:
WHT/BLK
WHT
RED/BLK
GRN/BLK
BLU/BLK
BLK/WHT
#2464, 24 G, 16 CONDUCTOR GRAY
J
CONNECTS TO
RED
RED/WHT
ORG
ORG/BLK
GRN
GRN/WHT
BLU
BLU/WHT
BLK
1 A 11,13,21,25
2 B 6
3 C 24
4 D 4
5 E 23
6 F 10
7 G
8 H 12
9 J 22
10 K
11 L
12 M
13 N
14 P
15 R
16 S 1,5,7
851-06AC20-16P50
TWISTED PAIR
SPKR A
SPKR RET
PTT A
RADIO RET
MIC A
GRN
BLK
WHT
BLK
RED
TWISTED PAIR
J
CONNECTS TO
B 16
E 17
D 18
C 19
A 20
RADIO CANNON
MS3106A14S-5S
CLEARLY VISIBLE BOLD LABEL
#2464, 24 G, 16 CONDUCTOR GRAY
CABLE LENGTH: 30 FT
RTM
RUBBER BOOT
16-PIN
851-06AC20-16P50
3/4" SHRINK
CABLE LENGTH: 10 FT
24 G, 6-CONDUCTOR GRAY
5-PIN
RUBBER BOOT MS3106A14S-5S
25-PIN DSUB FEMALE
CABLE LENGTH: 2 FT
24 G, 3-CONDUCTOR GRAY
9-PIN DSUB MALE
Seismic Source Co
RTM Decoder C Cable (EXT)
vvm
Rev 4.0
Sept 27 2006
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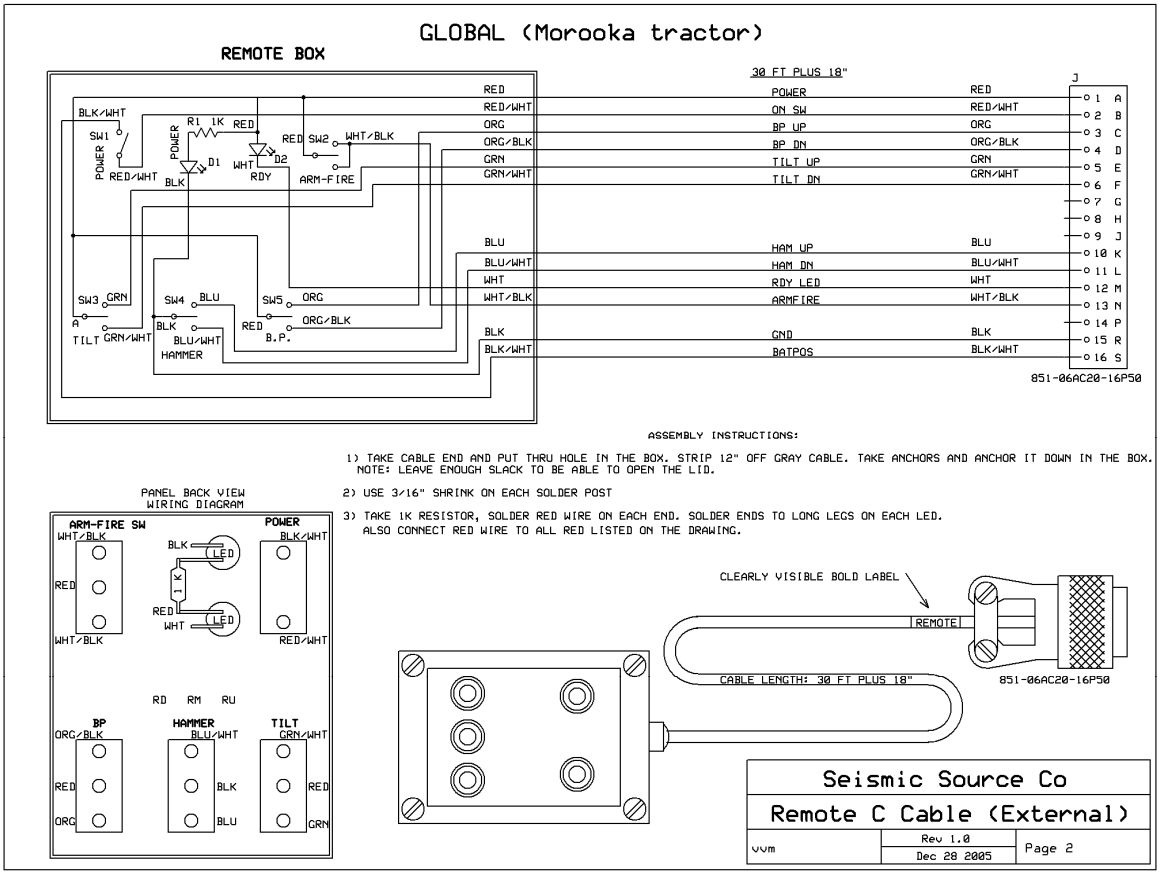
GLOBAL (Morooka tractor)
REMOTE BOX
30 FT PLUS 18"
J
POWER
ON SW
BP UP
BP DN
TILT UP
TILT DN
HAM UP
HAM DN
RDY LED
ARMFIRE
GND
BATPOS
RED
RED/WHT
ORG
ORG/BLK
GRN
GRN/WHT
BLU
BLU/WHT
WHT
WHT/BLK
BLK
BLK/WHT
SW1
SW2
SW3
SW4
SW5
R1 1K
D1
D2
RDY
ARM-FIRE
TILT
HAMMER
B.P.
851-06AC20-16P50
ASSEMBLY INSTRUCTIONS:
1) TAKE CABLE END AND PUT THRU HOLE IN THE BOX. STRIP 12" OFF GRAY CABLE. TAKE ANCHORS AND ANCHOR IT DOWN IN THE BOX.
NOTE: LEAVE ENOUGH SLACK TO BE ABLE TO OPEN THE LID.
2) USE 3/16" SHRINK ON EACH SOLDER POST
3) TAKE 1K RESISTOR, SOLDER RED WIRE ON EACH END. SOLDER ENDS TO LONG LEGS ON EACH LED.
ALSO CONNECT RED WIRE TO ALL RED LISTED ON THE DRAWING.
PANEL BACK VIEW
WIRING DIAGRAM
ARM-FIRE SW
POWER
BP
HAMMER
TILT
LED
1K
RD RM RU
CLEARLY VISIBLE BOLD LABEL
REMOTE
CABLE LENGTH: 30 FT PLUS 18"
Seismic Source Co
Remote C Cable (External)
Rev 1.0
Dec 28 2005
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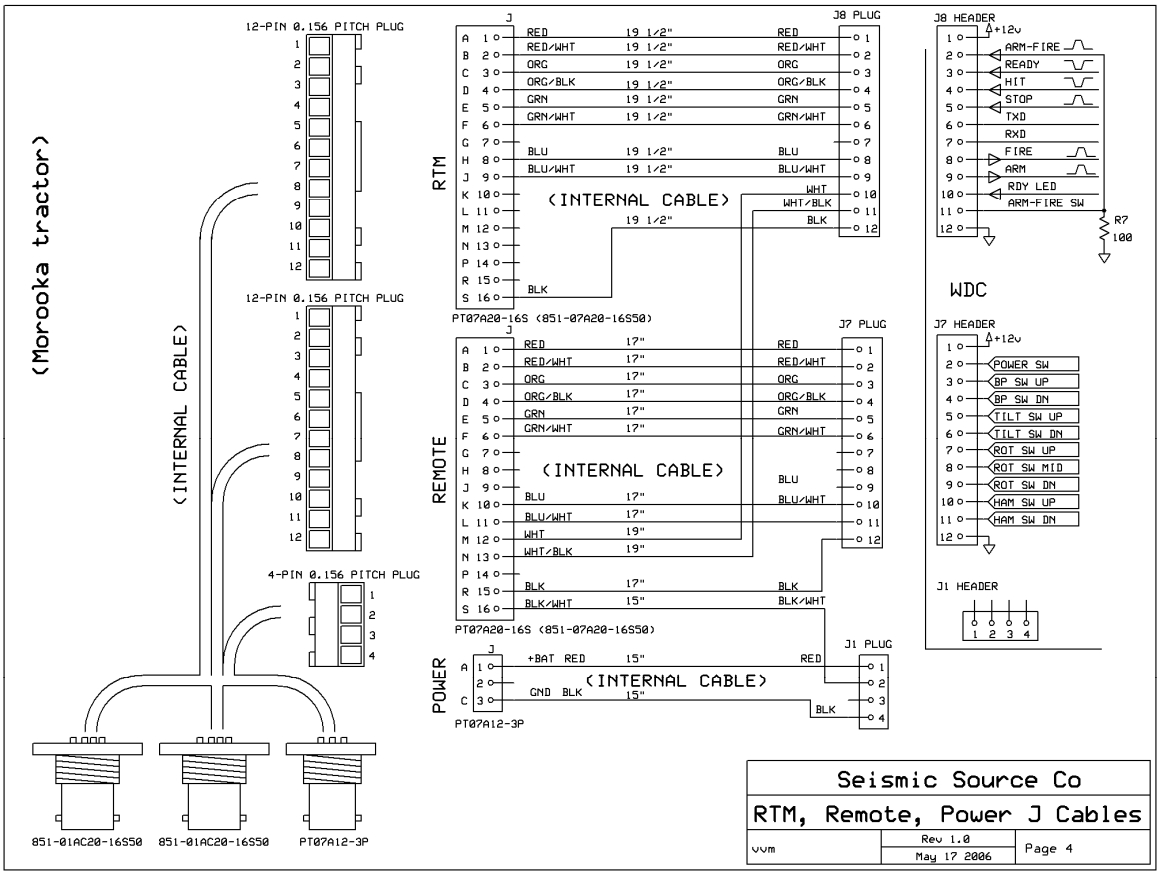
(Morooka tractor)
(INTERNAL CABLE)
12-PIN 0.156 PITCH PLUG
12-PIN 0.156 PITCH PLUG
4-PIN 0.156 PITCH PLUG
851-01AC20-16S50
851-01AC20-16S50
PT07A12-3P
RTM
REMOTE
POWER
J
J8 PLUG
J7 PLUG
J1 PLUG
(INTERNAL CABLE)
PT07A20-16S (851-07A20-16S50)
PT07A12-3P
J8 HEADER
+12v
ARM-FIRE
READY
HIT
STOP
TXD
RXD
FIRE
ARM
RDY LED
ARM-FIRE SW
R7
100
WDC
J7 HEADER
POWER SW
BP SW UP
BP SW DN
TILT SW UP
TILT SW DN
ROT SW UP
ROT SW MID
ROT SW DN
HAM SW UP
HAM SW DN
J1 HEADER
Seismic Source Co
RTM, Remote, Power J Cables
vvm
Rev 1.0
May 17 2006
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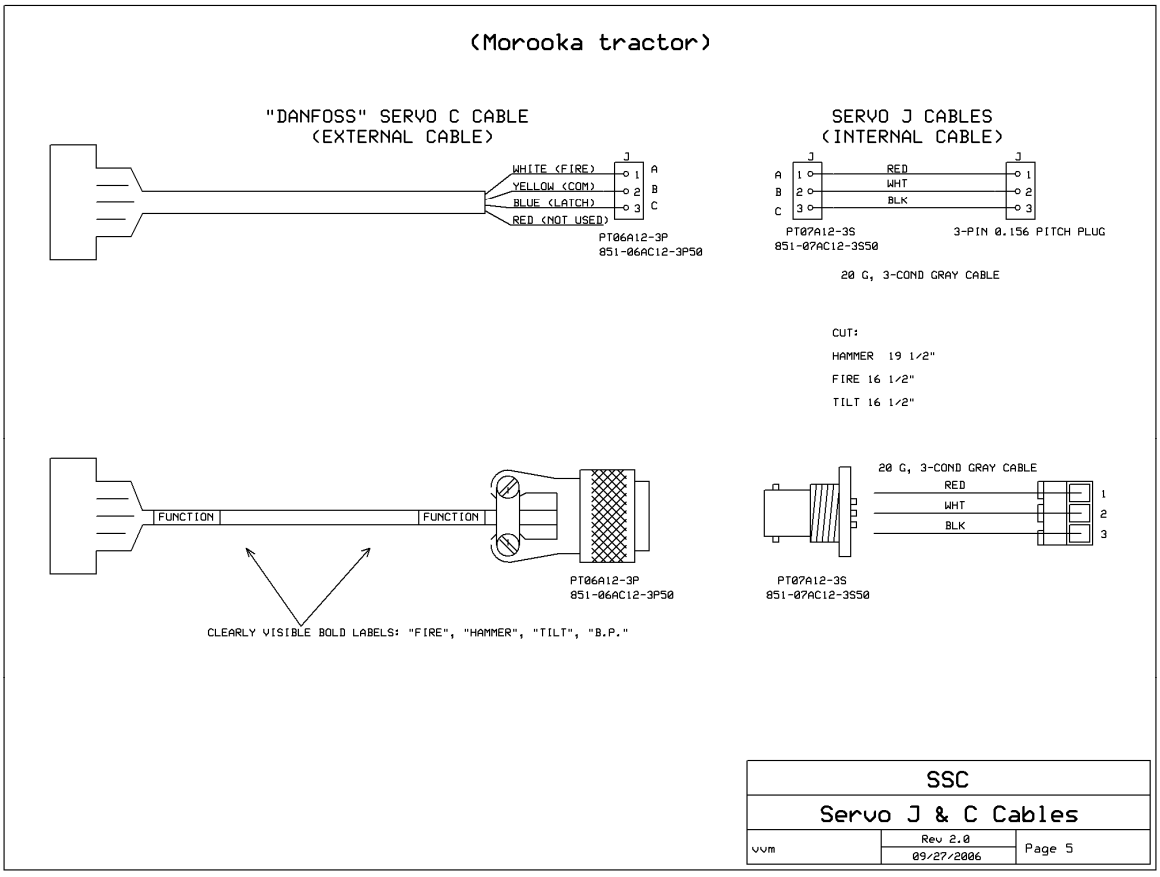
(Morooka tractor)
"DANFOSS" SERVO C CABLE
(EXTERNAL CABLE)
WHITE (FIRE)
YELLOW (COM)
BLUE (LATCH)
RED (NOT USED)
J
1
2
3
A
B
C
PT06A12-3P
851-06AC12-3P50
SERVO J CABLES
(INTERNAL CABLE)
RED
WHT
BLK
PT07A12-3S
851-07AC12-3S50
3-PIN 0.156 PITCH PLUG
20 G, 3-COND GRAY CABLE
CUT:
HAMMER 19 1/2"
FIRE 16 1/2"
TILT 16 1/2"
FUNCTION
FUNCTION
CLEARLY VISIBLE BOLD LABELS: "FIRE", "HAMMER", "TILT", "B.P."
SSC
Servo J & C Cables
vvm
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09/27/2006
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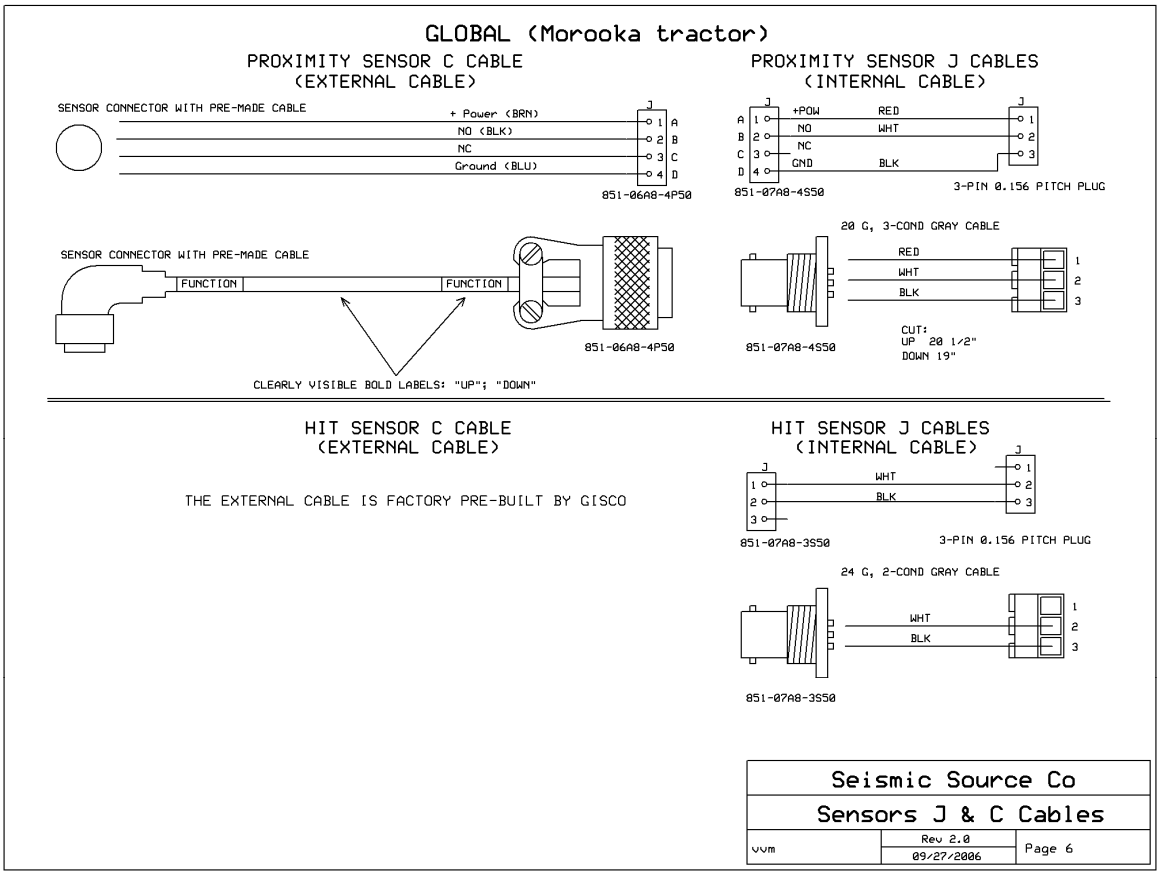
GLOBAL (Morooka tractor)
PROXIMITY SENSOR C CABLE
(EXTERNAL CABLE)
SENSOR CONNECTOR WITH PRE-MADE CABLE
+ Power (BRN)
NO (BLK)
NC
Ground (BLU)
J
1 A
2 B
3 C
4 D
851-06A8-4P50
SENSOR CONNECTOR WITH PRE-MADE CABLE
FUNCTION
FUNCTION
851-06A8-4P50
CLEARLY VISIBLE BOLD LABELS: "UP"; "DOWN"
PROXIMITY SENSOR J CABLES
(INTERNAL CABLE)
J
A 1
B 2
C 3
D 4
+POW
NO
NC
GND
RED
WHT
BLK
J
1
2
3
851-07A8-4S50
3-PIN 0.156 PITCH PLUG
20 G, 3-COND GRAY CABLE
RED
WHT
BLK
1
2
3
851-07A8-4S50
CUT:
UP 20 1/2"
DOWN 19"
HIT SENSOR C CABLE
(EXTERNAL CABLE)
THE EXTERNAL CABLE IS FACTORY PRE-BUILT BY GISCO
HIT SENSOR J CABLES
(INTERNAL CABLE)
J
1
2
3
WHT
BLK
J
1
2
3
851-07A8-3S50
3-PIN 0.156 PITCH PLUG
24 G, 2-COND GRAY CABLE
WHT
BLK
1
2
3
851-07A8-3S50
Seismic Source Co
Sensors J & C Cables
vvm
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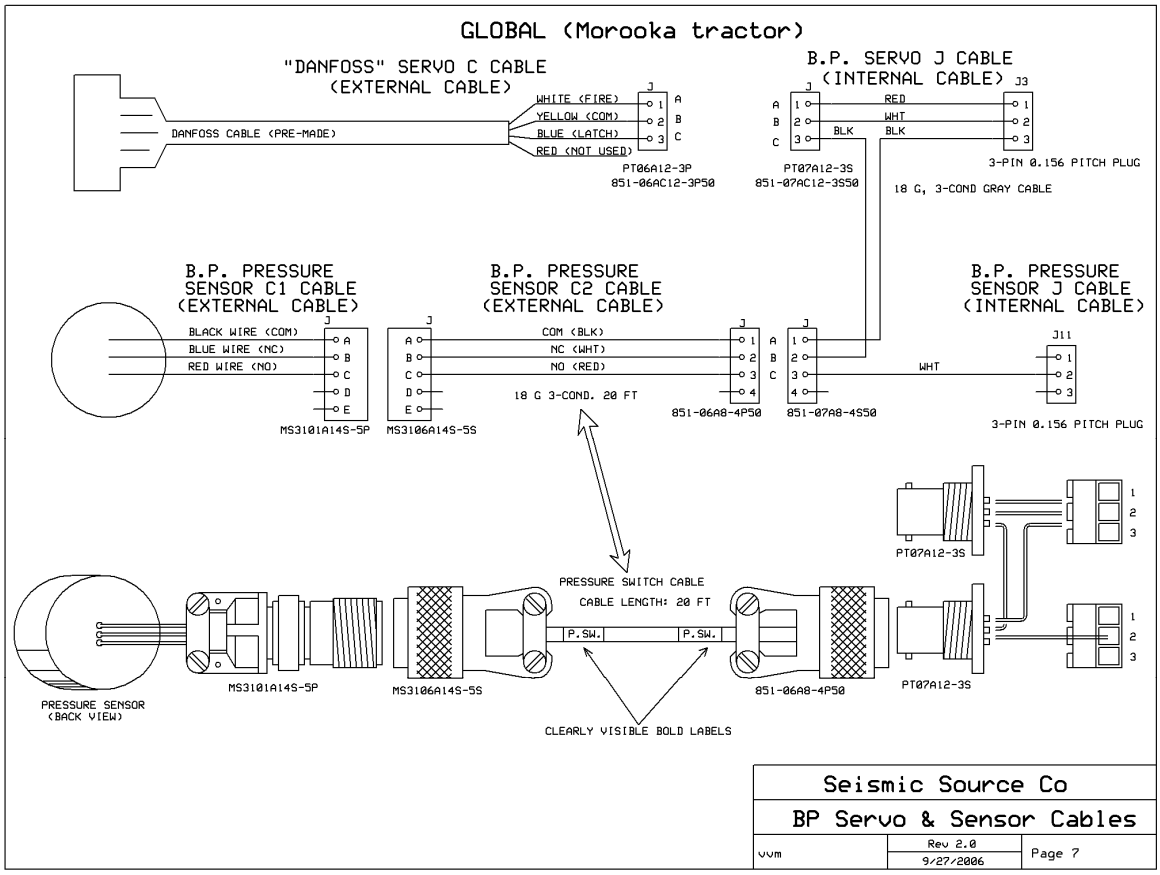
GLOBAL (Morooka tractor)
"DANFOSS" SERVO C CABLE
(EXTERNAL CABLE)
DANFOSS CABLE (PRE-MADE)
WHITE (FIRE)
YELLOW (COM)
BLUE (LATCH)
RED (NOT USED)
PT06A12-3P
851-06AC12-3P50
B.P. SERVO J CABLE
(INTERNAL CABLE)
RED
WHT
BLK
BLK
PT07A12-3S
851-07AC12-3S50
3-PIN 0.156 PITCH PLUG
18 G, 3-COND GRAY CABLE
B.P. PRESSURE
SENSOR C1 CABLE
(EXTERNAL CABLE)
BLACK WIRE (COM)
BLUE WIRE (NC)
RED WIRE (NO)
MS3101A14S-5P
MS3106A14S-5S
B.P. PRESSURE
SENSOR C2 CABLE
(EXTERNAL CABLE)
COM (BLK)
NC (WHT)
NO (RED)
18 G 3-COND. 20 FT
851-06A8-4P50
851-07A8-4S50
B.P. PRESSURE
SENSOR J CABLE
(INTERNAL CABLE)
WHT
J11
3-PIN 0.156 PITCH PLUG
PRESSURE SWITCH CABLE
CABLE LENGTH: 20 FT
P.SW.
P.SW.
PRESSURE SENSOR
(BACK VIEW)
MS3101A14S-5P
MS3106A14S-5S
851-06A8-4P50
PT07A12-3S
PT07A12-3S
CLEARLY VISIBLE BOLD LABELS
Seismic Source Co
BP Servo & Sensor Cables
vvm
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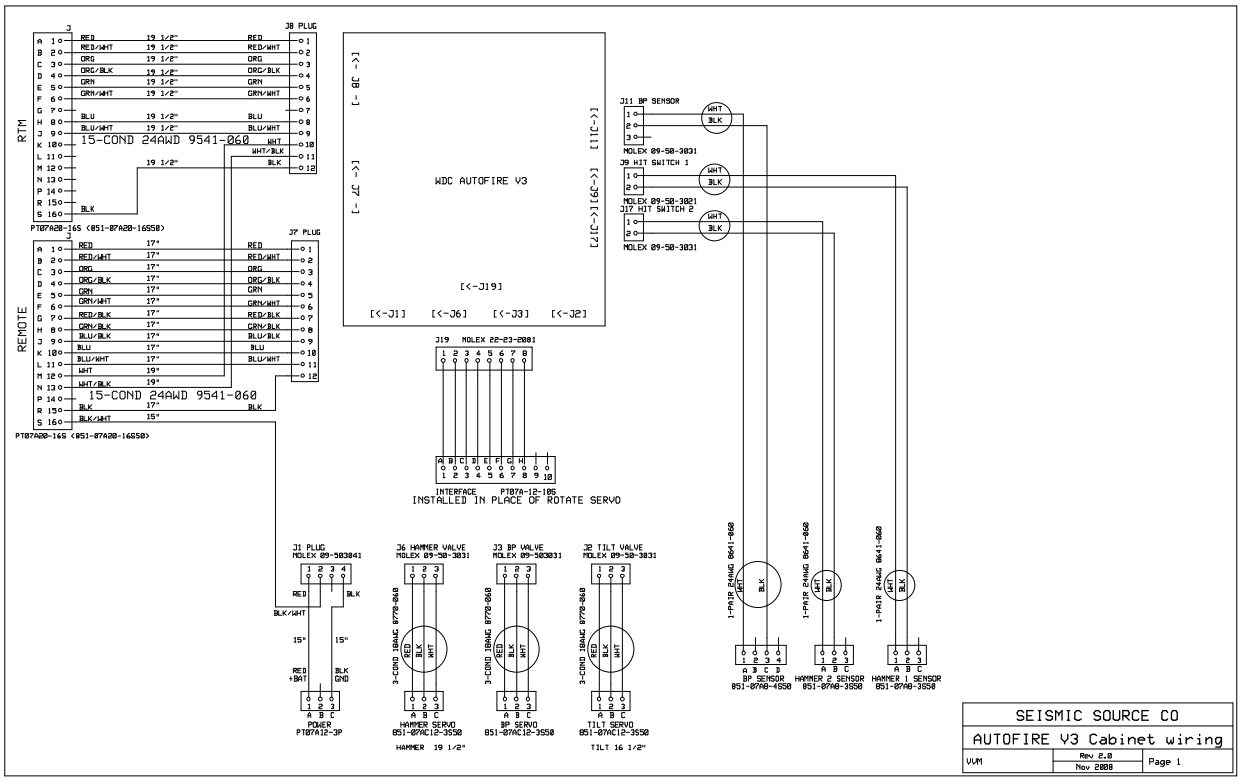
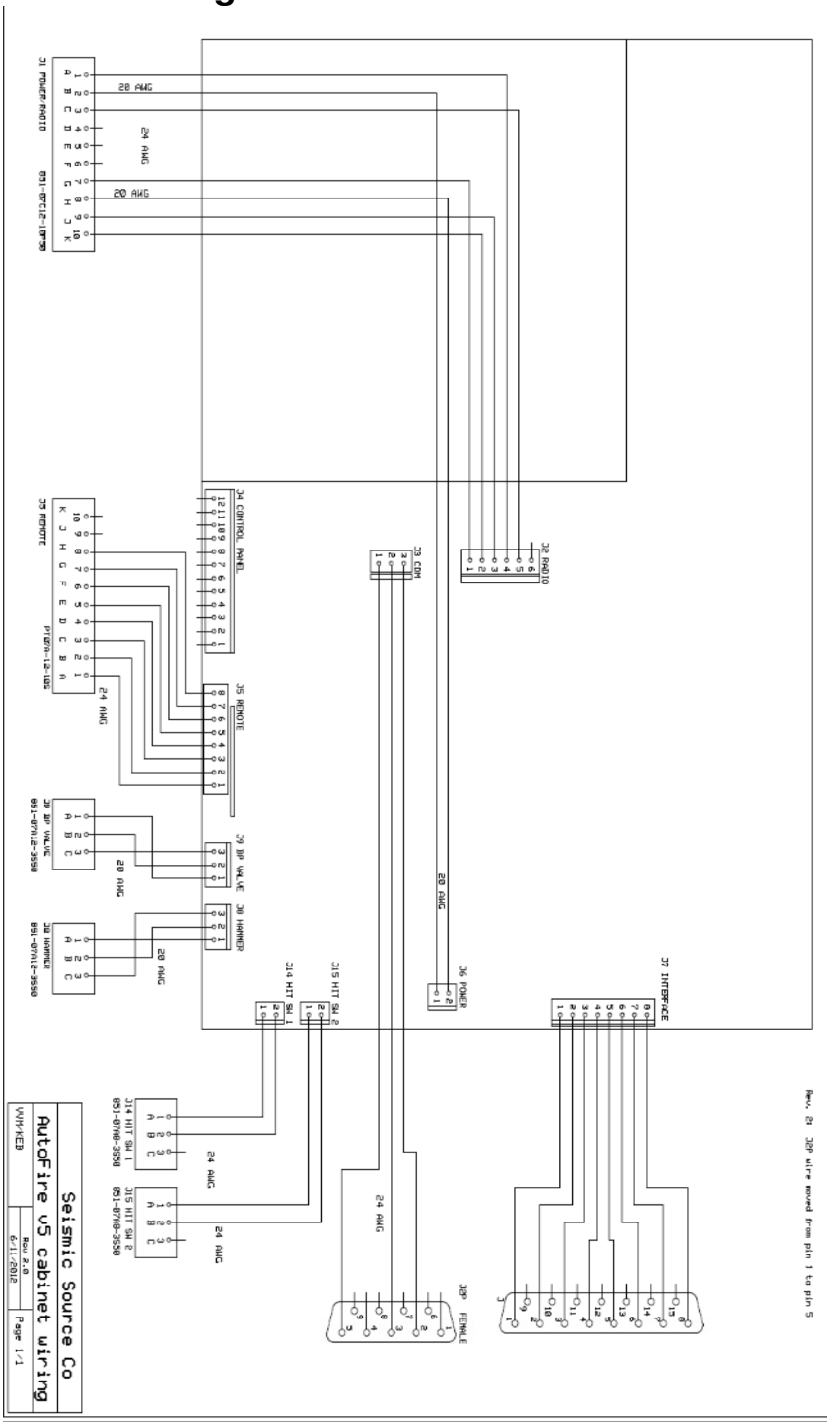
WDC AUTO-FIRE Ver 3.3 Wiring Schematics



Note: This drawing shows only WDC cabinet internal wiring. All external cables and components needed for AUTO-FIRE (Rapid Fire) AWD operation are similar to WDC Ver 5.5 wiring.

WDC AUTO-FIRE Ver 5 Wiring Schematic

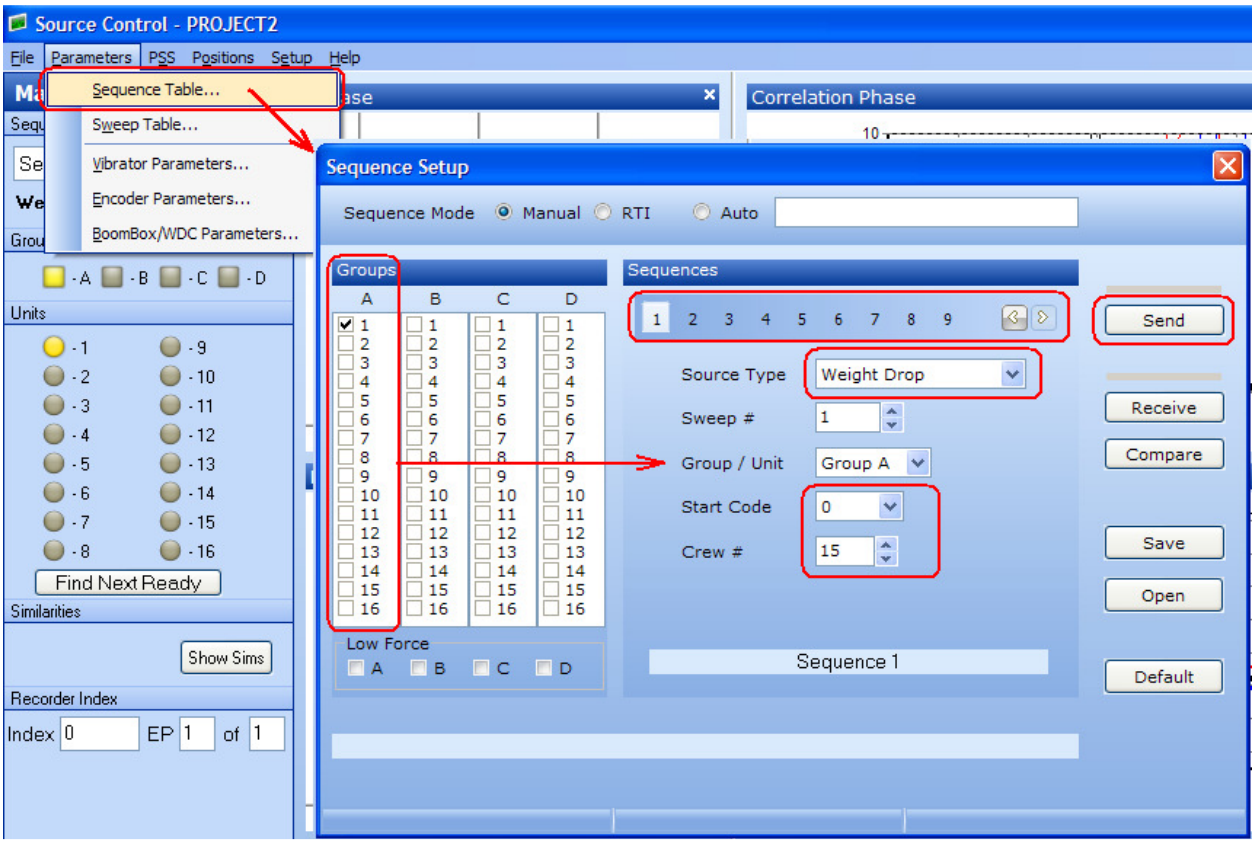


Note: This drawing shows only WDC cabinet internal wiring. All external cables and components needed for AUTO-FIRE (Rapid Fire) AWD operation are similar to WDC Ver 5.5 wiring except the Remote box external cable.

Universal Encoder and Source Control Program Setup for WDC Operation.

Universal Encoder (UE) is a very important component of the AWD operation. It is designed to reproduce the state of the AWD unit to the Observer, including unit ID, position, and timing of the asynchronous event. The level of control for the fleet of the AWD units on the crew is directly related to the recording system software and how it interfaces with UE.

In Source Control select Parameters and Sequence Table and make sure it is setup as shown in the example below.

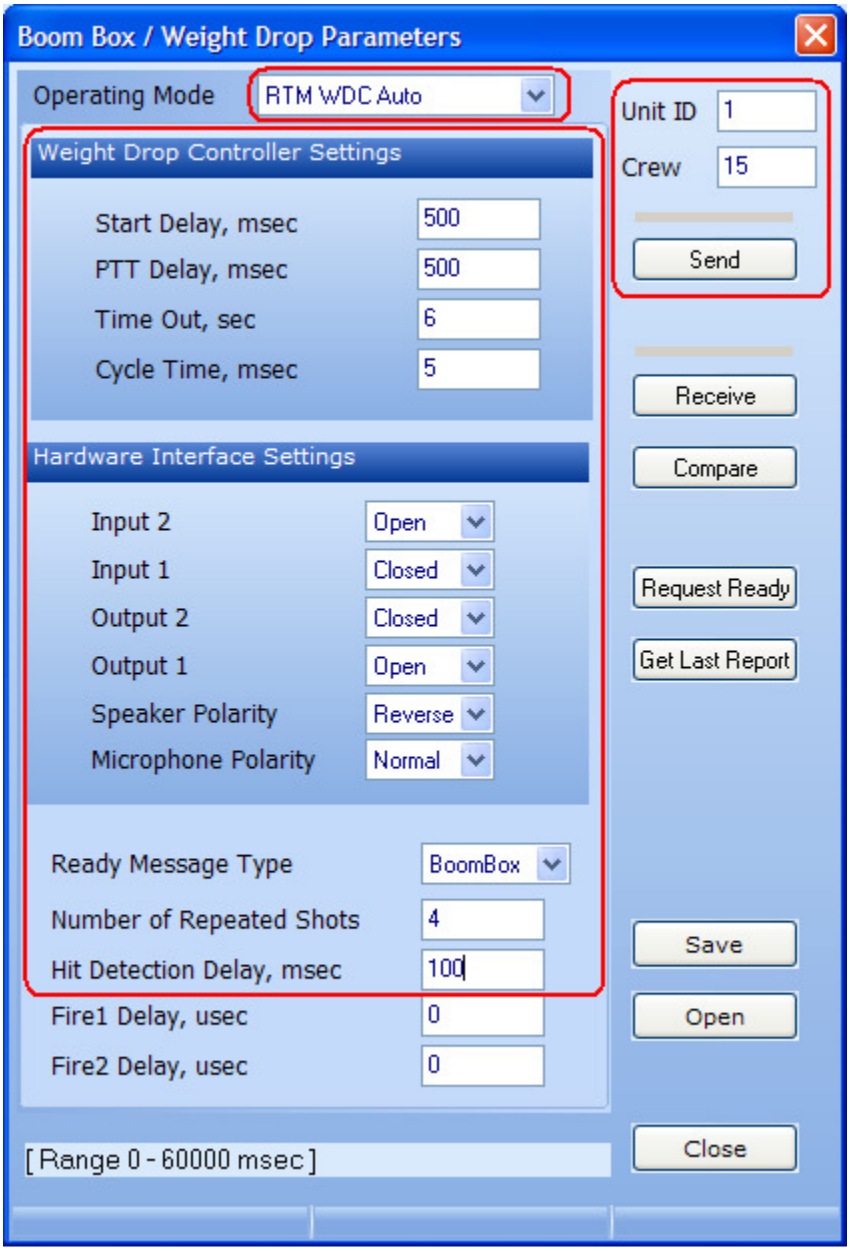


The key setting for WDC operation are highlighted in red.
The Start Code and Crew number settings must match the same settings in RTM to insure radio communication.

The group selection must have RTM unit IDs all selected. Each sequence has group selection embedded. Some recording systems are able to control UE Sequence number by means of Recording Truck Interface (RTI). Other advantage of RTI is to pass back to recording system post shot information, such as AWD unit position and performance, if available.
UE RTI setup is done in Encoder parameters and Setup->Comm Settings…

Access RTM Setup with Source Control Program

In Source Control select Parameters and BoomBox/WDC Parameters.



For multiple shot per shot point operations select “RTM WDC Auto”. This selection allows you to define multiple shots in the screen above and upload this to RTM over radio link. To do this, please follow these simple steps:

- Type Unit ID and Crew number for RTM you wish to access. The RTM’s ID and Crew number is displayed on the RTM display.
- Click “Receive” button to download RTM parameters. This is very important step, to insure minimum necessary changes in RTM’s setup.
- Change parameter, for example “Number of Repeated Shots” to desired number.
- Click “Send” button, to upload new setup to RTM.

Universal Encoder Timing and Available Outputs in WDC Mode

For the UE timing please refer to diagram “RTM Timing in the Manual Mode (11h)”.
The UE timing to reproduce Confirmation Time Break (CTB) to the recording system is similar in all modes of operation. CTB timing is approximately 10 millisecond (+/- 20 microsecond) delayed from the real event depending on the radios used and the distance from the recorder.
The UE outputs the CTB pulse on the Time Break output. This output is available on the 25-pin DSUB connector on the bottom of the UE (pin 15 – Time Break Active and pin 3 – Time Break Return) and for quality control purposes available on the UE front panel Time Break BNC connector. Before the CTB signal occurs, the UE outputs a recorder start signal, which can be used to arm the recording system. This is an optional signal and can be used if necessary. The Recorder Start signal is available only on the 25-pin DSUB connector, pin 4 – Recorder Start Active and pin 17 Recorder Start Return.
More information on these signals can be found in the Universal Encoder manual.

Radio Trigger Module (RTM II) Manual

RTM Overview

The Weight Drop Source does not have repeatable delay from when it is commanded to Fire to when the hammer hits the pad. To overcome this problem, the Hammer switch is used to initiate the Recorder. When the "Hammer Switch" is hit, then the RTM units modulates the hit command back to the recorder and a "Time Break" signal is output from the Encoder RTM. This "Time Break" signal at the RTM Encoder is approximately 10 msec after the Hammer hits the ground. The tests that we have performed show that the repeatability of this method is very good (better than 40 microseconds).

The smaller recording systems, like the Seistronix's or the DAQlink unit, are ready for a Time Break signal at anytime and will start recording as soon as the time break is applied to the system. These recorders can also remove the 10 msec delay from when the Hammer actually hit and when the Time Break occurs at the Encoder.

The bigger recording systems like the ION and the Sercel recording systems require an "external start" and a "start up delay" before they are ready for a Time Break signal. When the Weight Drop unit is commanded to fire, the RTM at the decoder first sends a "Ready message" to the Encoder. This ready message is decoded by the Encoder RTM unit and the Remote Start (Output 2) to the Recording System is sent out. This output 2 is used to start the Recording system. After the ready message is sent out, the Decoder RTM waits a user settable delay (PTT delay) before the Weight Drop unit is commanded to fire. This "PTT delay" entry is used to allow the recording system enough time to be ready for the Time Break signal. After the "PTT delay", the RTM at the decoder commands the Weight Drop unit to fire, and then waits for the Hammer switch to "hit". When the "hit" occurs, then the "hit message" is sent to the RTM Encoder. The RTM Encoder, decodes the "Hit message" and outputs "Time Break". (The modulation and demodulation of the "hit message" requires 10 msec).

The "Hammer Switch" signal is very important for accurate timing. Normally the "Hammer Switch" is isolated in a rubber mount to improve reliability and eliminate false hits. The "Hammer Switches" are made for use on a sledge hammer; there is a marking on some of the Hammer Switches - "This side Up". For the Weight Drop Sources the mounting is reversed. For proper operation on the Weight Drop system, the "This Side Up" label should be mounted on the bottom. There are occasional false hits detected when the hammer is released. There is a software entry to ignore the signal from the Hammer switch for a given amount of time after the fire command (Hit Detection Delay). The "Mechanical Delay" is defined has the time between when the Weight drop unit is commanded to fire and when the "Time Break" is detected. Typical value of the "Mechanical Delay" is around 500 msec. This delay is shown on the display of the RTM Decoder and Encoder units in the lower right hand corner. This "Mechanical Delay" should be consistent to + or - 20 milliseconds. If it is moving large amounts, then there is something wrong with the Hammer Switch, Hold Down Weight, or Hit

Detection Delay. The "Hit Detection Delay" should be set to about 200 milliseconds; this should eliminate the false hits when the hammer is released.

RTM Applications

The original RTM module was designed with wide variety of applications in mind, such as wireless synchronization of different hammer source types, real time data transmission, master-slave applications and more.
Considering recent popularity of hydraulically driven AWD sources, RTM-II was built to improve interface to WDC.

The following are examples of RTM applications:
- Sledge hammer synchronization to recording system:
Two RTM modules are used as a hammer switch extension. The RTM units are used to trigger a remote recording system 10 milliseconds after the sledge hammer (the seismic source) has hit the ground.

- Betsey gun synchronization:
Two RTM units are used as a hammer switch extension. The RTM units are used to trigger a remote recording system 10 milliseconds after the Betsy gun (the seismic source) has hit.

- Accelerated Weight Drop (AWD) synchronization:
When the AWD hits the base plate, the RTM sends a closure 10 milliseconds later to the remote recording system for the start of recording. This requires a RTM unit at the weight drop unit and either a RTM, Boom Box, or Universal Encoder at the recording system end.
Note: Depends on the AWD type, there are two completely different modes of operation supported by RTM, as described in WDC section of the manual. Please contact Seismic Source for detailed RTM setup. Usually this is done at the factory prior to the RTM shipping to end user.

- Synchronization with Boom Box:
A RTM unit can be used to issue time break from the radio start command at the same time the Boom Box encoder and decoder issue time break. This can be used to start a second remote recording system. The RTM can also issue a 201 millisecond pre-start pulse prior to time break if needed.

- Synchronization with Pelton VibPro, Advance II, and ShotPro:
A RTM unit can be used to issue time break from the radio start command at the same time the VibPro encoder/decoder, Advance II encoder/decoder, and ShotPro encoder/decoder issue time break. This can be used to start a second remote recording system.

- HFVS applications:
RTM units can be used to receive Recording system serial Shot ID message. Then this message can be sent during the sweep to the vibrator. The Shot ID information is serially sent to the DAQLink in the vibrator. Then the DAQLink adds the file number from the Shot ID information to the HFVS data so the data processors can tie the data together.

RTM Hardware Description

RTM Lights

Right LED flashes when unit in ON.
Middle LED comes on when Output 2 is on or Input 2 is triggered.
Left LED comes on when Output 1 is on or Input 1 is triggered.

RTM Display

The display shows following information:
Current RTM mode of operation
The state of WDC
The status of hammer switch detection
The count number in Auto mode

The board rev. May 12 2004 contains following inputs and outputs on 25-pin D-Sub connector:

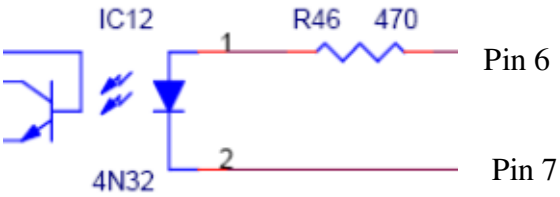
Input 1	pin 4 (Non-ISO Active)	pin 5 (Non-ISO Return)
Input 2	pin 6 (ISO Active)	pin 7 (ISO Return)
Input 3	pin 24 (Non-ISO Active)	(Non-ISO Return – Battery negative)
Input 4	pin 23 (Non-ISO Active)	(Non-ISO Return – Battery negative)
Output 1	pin 8 (ISO Active)	pin 9 (ISO Return)
Output 2	pin 11 (ISO Active)	pin 12 (ISO Return)
Output 3	pin 21 (ISO Active)	pin 22 (ISO Return)

Each signal in **BOLD** letters describes active edge polarity and is software selectable.
All other signals polarity is fixed in the firmware and cannot be changed.

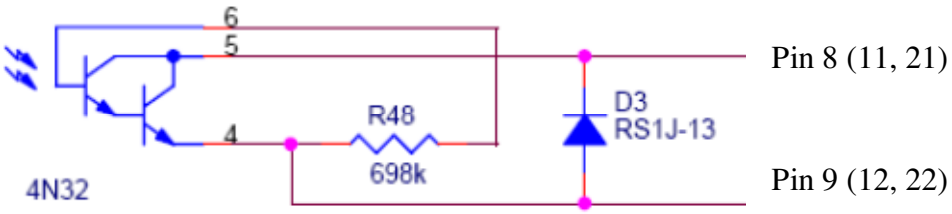
Signal Name	*Encoder side Function*	*Impulse side Function*	*Condition*
Input 1	Start from Recorder	Hammer switch	Selectable
Input 2	Not used	Start Fire Cycle	High to Low
Input 3	Not used	Hammer Ready *	High to Low
Input 4	Not used	B.P. UP (Stop)	Low to High
Output 1	Confirmed Time Break	Not used	Selectable
Output 2	ARM to Recorder	Fire	Selectable
Output 3	Not used	Arm	Low to High

* Note – Can be bypassed by setting SW3.3 = ON (RTM board)

The Input 2 circuit schematic is shown below:



The Output 1 (Outputs 2, 3 are identical) circuit is shown below:



Input 1, 3, 4 are Non Isolated inputs and special care must be taken in order to avoid damage of the RTM circuits. The table below summarizes maximum allowable voltage for each input.

Name	*Voltage range and comments*
Input 1	0 – 12V
Input 3	Dry contact closure to RTM Battery negative
Input 4	0 – 12V

RTM Firmware Description

The RTM firmware provides 5 different modes for a communication link between the Weight Drop type of source signal and a recording system:

- Weight Drop Automatic (mode 10h)
- Weight Drop Manual (mode 11h)
- Weight Drop Decoder (mode 12h)
- Weight Drop Encoder (mode 13h)
- Weight Drop Fast Mode (mode 14h)

The RTM in modes 10h, 11h, 12h, and 14h must be wired to remote impulse source, while RTM in mode 13h must be connected to a recorder.

The RTM modes 12h and 13h complement each other.

Impulse Unit Starts Recorder – Single Shot Mode

Set RTM Mode to Weight Drop Manual (11h) for one RTM and Weight Drop Encoder (13h) for the other RTM. Manual mode is used for impulse sources not requiring the WDC equipment.
Mode Manual is located at the impulse source (**RTM 1**) and Mode Encoder at the Recorder (**RTM 2**)
Names **RTM 1** and **RTM 2** are used only to simplify this manual.

RTM1 signals:

Input 1 – Hammer hit
Input 2 – Arm-Fire button
Input 3 – Signal from WDC when ready for new cycle.
Output 1 – Signal 1 millisecond after hit occurred
Output 2 – Fire pulse to WDC
Output 3 – Arm pulse to WDC

RTM2 signals:

Input 1 – Not used
Input 2 – Not used
Output 1 – Confirmation Time Break
Output 2 – Starts recording system

***Operation*:**
The impulse unit **RTM 1** cycle is started by a signal on **Input 2**. The signal polarity is set by software entry in the RTM program. The signal source is a mechanical limit switch, proximity sensor or push button. In the case of using the **RTM** with the WDC, the result of toggling **Input 2** depends on the Ready signal (Input3). If the ready input is high, toggling **Input 2** will cause the RTM to arm an impulse unit. If the ready input is low (Impulse Unit Armed), toggling **Input 2** will start the firing cycle.

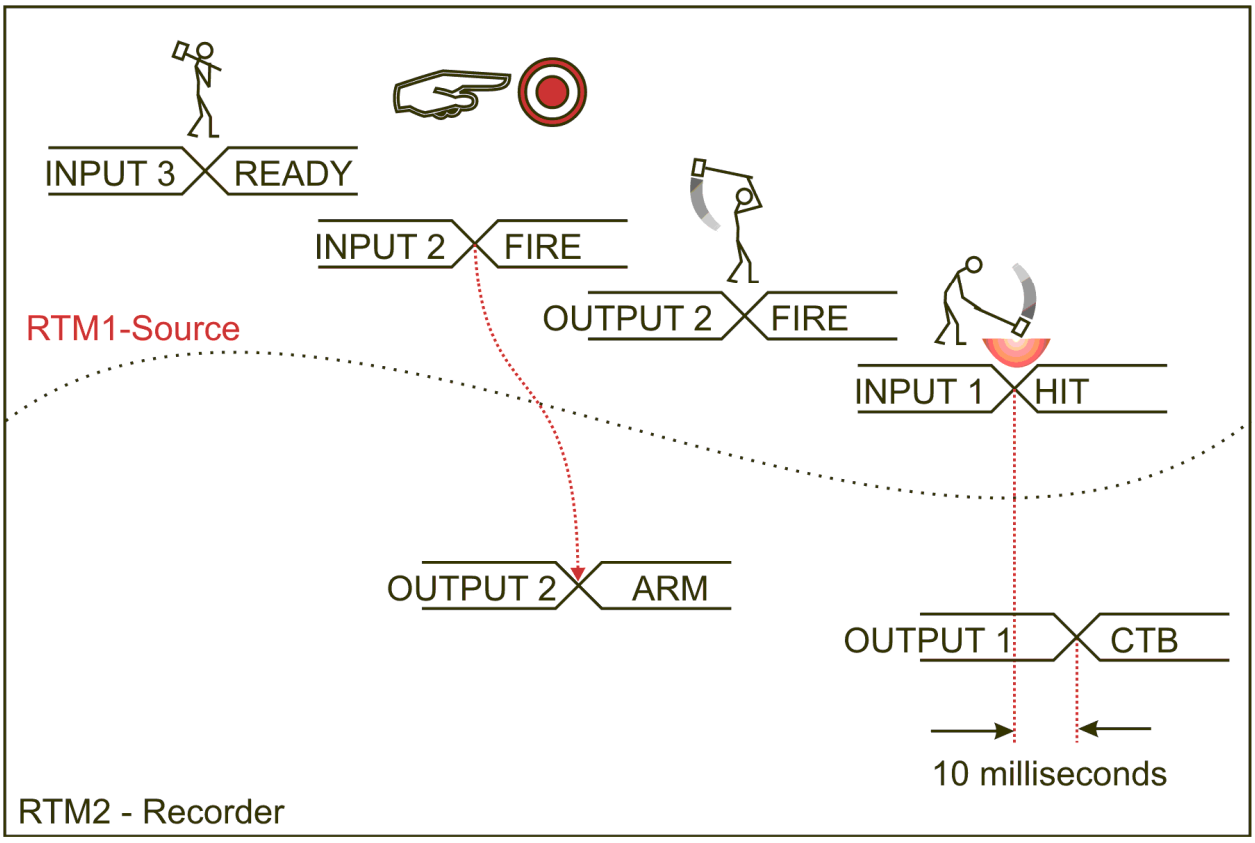
When using the RTM in stand alone mode, change SW3**.**3 to "ON". This causes the RTM to always be ARMED. Since SW3 is "ON", the RTM sees that the WDC is always ready. When Input 2 is toggled the first time, the fire cycle is started. The **RTM 1** keys up the VHF radio and sends a 2500 Hz tone. The VHF radio needs a minimum of 200 msec to warm up. The entry **Weight Drop Start Delay** allows increasing this time**.** At the end of the **Weight Drop Start Delay,** the **RTM 1** located at the impulse source sends out the READY MESSAGE to the **RTM 2** unit located at recorder.

The **RTM 2** at the recorder receives the **READY MESSAGE** and issues a signal on the **Output 2** line. The signal polarity is set by software entry in the RTM program. This signal can be wired to recorder ARM input, to enable the recording system for the following shot. At the same time the **RTM 2** will output the READY MESSAGE on the serial bus.

The impulse unit **RTM 1** starts transmitting the 2500 Hz tone on the radio. After the **FIRE Delay** entry time, **RTM 1** outputs a pulse on the **Output 2** line. The signal polarity is set by software entry in the RTM program. This signal can be used to start an impulse unit (to fire the hammer for example).

The impulse unit **RTM 1** waits for the HIT signal on the **Input 1** line. The signal polarity is set by software entry in the RTM program. The signal can be provided by the Hammer switch. When the HIT occurs, the impulse unit **RTM 1** outputs the HIT message on the VHF radio. The impulse unit **RTM 1** will wait for the HIT to occur within the amount of time in the **Time Out** entry. After the Hit Message is sent or the Time Out period is over, the post report is sent.

The recorder unit **RTM 2** receives the HIT message and outputs the CONFIRMATION TIME BREAK signal on the **Output 1** line. The signal polarity is set by the software entry in the RTM program.
Note: The CONFIRMATION TIME BREAK pulse on the **RTM 2 Output 1** line is delayed 10 msec after the HIT occurred at the impulse unit **RTM 1.** After **RTM 2** receives the post report message the information is sent to the computer and RTI ports.



Impulse Unit Starts Recorder – Automatic Mode

Set RTM Mode to Weight Drop Automatic (10h) for one RTM and Weight Drop Encoder (13h) for the other RTM. The RTM in Automatic mode is located at the impulse source (**RTM 1**) and Mode Encoder at the Recorder (**RTM2**)
Names **RTM 1** and **RTM 2** are used only to simplify this manual.

RTM1 signals:

Input 1 – Hammer hit
Input 2 – Arm-Fire button
Input 3 – Signal from WDC when ready for new cycle.
Input 4 – Signal from Base Plate Up switch
Output 1 – Signal 1 millisecond after hit occurred
Output 2 – Fire pulse to WDC
Output 3 – Arm pulse to WDC

RTM2 signals:

Input 1 – Not used
Input 2 – Not used
Output 1 – Confirmation Time Break
Output 2 – Starts recording system

***Operation*:**
The impulse unit **RTM 1** cycle is started by a signal on **Input 2**. The signal polarity is set by software entry in the RTM program. The signal source is a mechanical limit switch, proximity sensor or push button. In Auto Mode, toggling the **Input 2** line causes **RTM 1** to arm the Impulse unit. Then **RTM 1** waits for the Impulse unit to be armed. After the Impulse Unit is Ready, **RTM 1** will wait for **Input 2** line to be toggled again before starting the firing cycle.

The **RTM 1** keys up the VHF radio and sends a 2500 Hz tone. The 2500 Hz tone will last the duration of entry **Weight Drop Start Delay**. At the end of the **Weight Drop Start Delay,** the **RTM 1** located at the impulse source sends out the READY MESSAGE to the **RTM 2** unit located at the recorder. If the READY MESSAGE TYPE is set to NONE, the Ready Message will not be sent to RTM2. This selection will cause the fire command to be issued sooner.

The **RTM 2** at the recorder receives the READY MESSAGE and issues a signal on the **Output 2** line. The signal polarity is set by software entry in the RTM program. This signal can be wired to recorder ARM input, to enable the recording system for the following shot. At the same time the **RTM 2** will output the READY MESSAGE on the serial bus.

The impulse unit, **RTM 1,** starts transmitting the 2500 Hz tone on the radio. After the **FIRE Delay (PTT Delay)** entry time, **RTM 1** outputs a pulse on the **Output 2** line. The signal polarity is set by software entry in the RTM program. This signal is used to start an impulse unit.

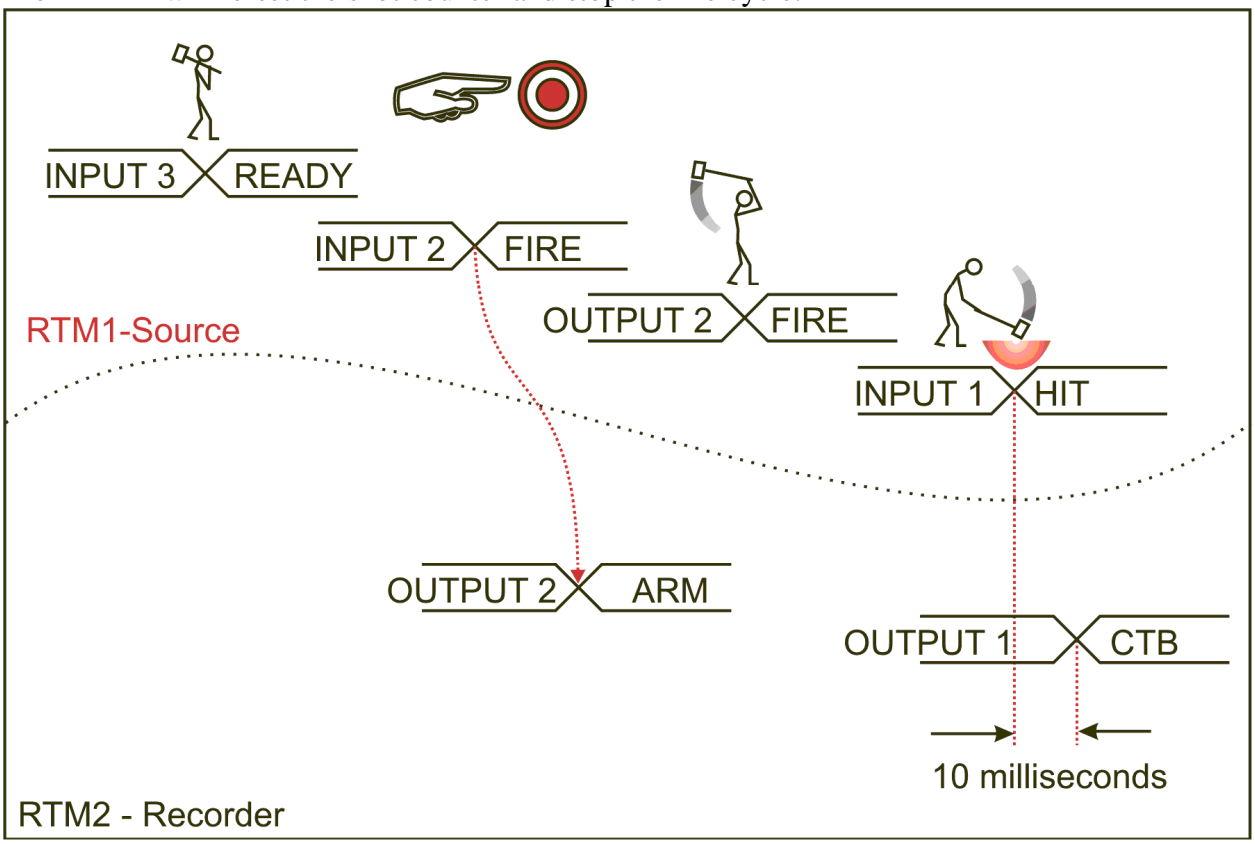
The impulse unit, **RTM 1,** waits for the HIT signal on the **Input 1** line. The signal polarity is set by software entry in the RTM program. The signal can be provided by hammer switch, limit switch, etc. When the HIT occurs, the impulse unit, **RTM 1,** outputs the HIT message on the VHF radio. The impulse unit, **RTM1,** will wait for the HIT to occur within the amount of time in the **Time Out** entry. After the Hit Message is sent or the Time Out period is over, the post report is sent.

The recorder unit, **RTM 2,** receives the HIT message and outputs the CONFIRMATION TIME BREAK signal on the **Output 1** line. The signal polarity is set by the software entry in the RTM program.
Note: The CONFIRMATION TIME BREAK pulse on the **RTM 2 Output 1** line is delayed 10 msec after the HIT occurred at the impulse unit **RTM 1.** After **RTM 2** receives the post report message the information is sent to the computer and RTI ports.

The Impulse Unit, **RTM 1,** waits for the entered **Cycle Time,** then **RTM 1** check if the number of hits taken is equal to the entry, **Number of Repeated Shots.** If equal, the fire process is stopped. If less, then **RTM 1** sends the arm command to arm the Impulse Unit and the fire cycle is continued. Setting cycle time to less than 4 will cause the RTM1 to issue the Arm Command after the hit and not after Cycle Time. This will result in a faster turn-around time. This also affects position of the hammer after the last shot (on top or bottom).

If the hit does not occur during the period of time defined by the **Time Out** entry, **RTM 1** will arm the Impulse Unit but will not increment the shot counter. The Fire Cycle will continue.

To stop RTM firing cycle, raise the Base Plate UP switch momentary or power cycle RTM.
The **RTM 1** will re-set the shot counter and stop the fire cycle.



Recorder Starts Impulse Unit

Set the modes Weight Drop Decoder (12h) for one RTM and Weight Drop Encoder (13h) for the other RTM. The Encoder (**RTM 1**) must be located at the recorder and Decoder (**RTM 2**) at the impulse source. Names **RTM 1** and **RTM 2** are used only to simplify this manual.

RTM1 signals:

Input 1 – Start from recorder
Input 2 – Not used
Output 1 – Time Break
Output 2 – Not used

RTM2 signals:

Input 1 – Hammer hit
Input 2 – Arm-Fire button
Input 3 – Signal from WDC when ready for new cycle.
Output 1 – Signal 1 millisecond after hit occurred
Output 2 – Fire pulse to WDC
Output 3 – Arm pulse to WDC

Operation:

The impulse unit, **RTM 2,** cycle is started by a signal on **Input 2**. The signal polarity is set by software entry in the RTM program. The signal source is a mechanical limit switch, proximity sensor or push button. In Decoder Mode, toggling the **Input 2** line causes the **RTM 2** to arm the Impulse unit. Then **RTM 2** waits for the Impulse unit to be armed. After the Impulse Unit is Ready, **RTM 2** will wait for **Input 2** line to be toggled again before starting the firing cycle or a radio start command.

The recorder unit, **RTM 1,** receives START pulse from recording system on the **Input 1** line. The signal polarity is set by software entry in the RTM program. RTM1 sends the start code message.

The Privacy Settings, Start Code and Crew ID must match between Encoder and Decoder for the radio start code to work. The Encoder's units to fire entry must contain the decoder RTM unit ID.

The impulse unit, **RTM 2,** receives the START CODE message. The **RTM 2** waits **FIRE Delay** (**PTT Delay**) time before outputting the START signal on the **Output 2** line. The signal polarity is set by software entry in the RTM program. The value in the recorder unit, **RTM 1, Start Delay** entry and **RTM 2, FIRE Delay (PTT Delay)** will determine the length of time from the recorder starting the **RTM 1** and the START signal on the **RTM 2 Output 2** line.

After the START CODE reception, the **RTM 2** impulse unit outputs a 2500 Hz signal on the VHF radio and then waits for the HIT signal on the **Input 1** line. The signal polarity is set by the software entry in the RTM program.

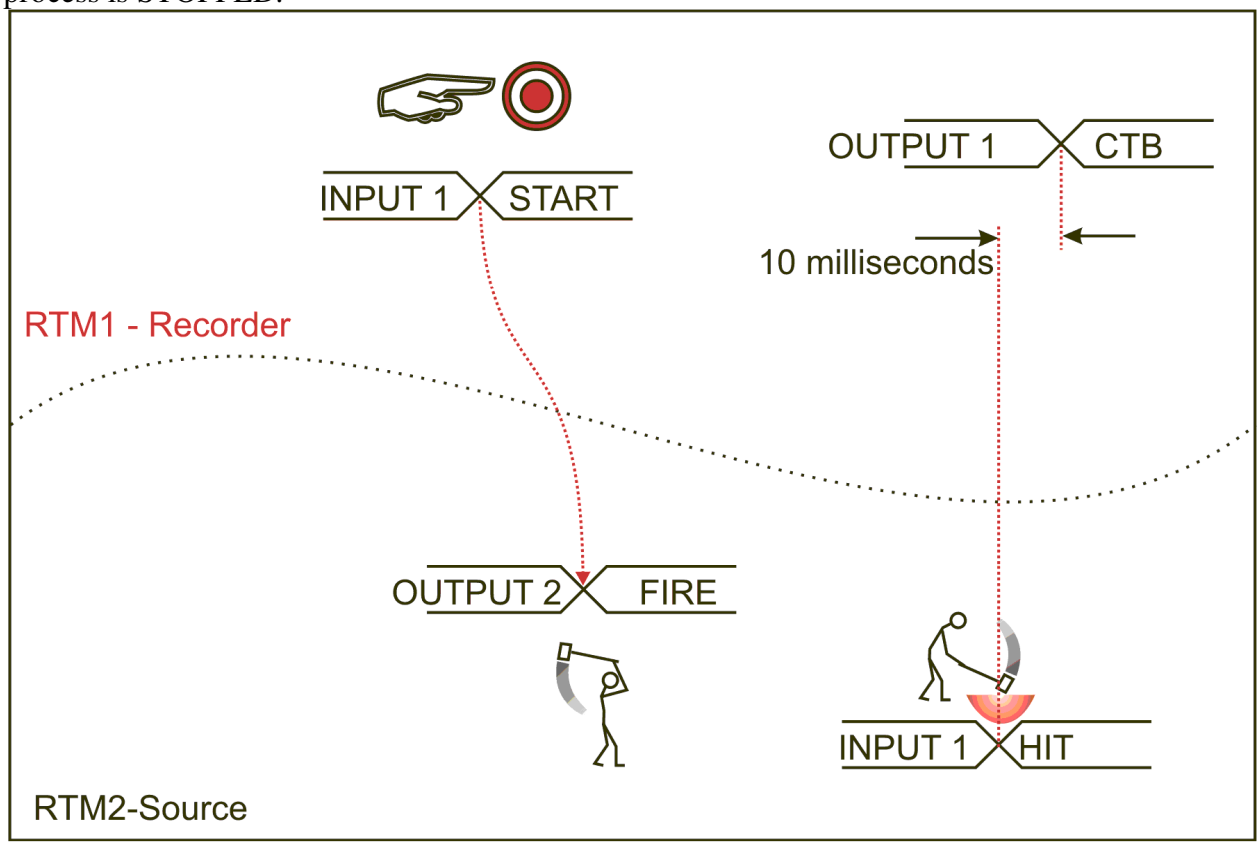
When the HIT pulse occurs the **RTM 2** impulse unit outputs the HIT radio message on the VHF radio. The impulse unit, **RTM 2,** will wait for the HIT to occur the amount of time in the **Time Out** entry. If the hit was started by a radio start code, after the HIT pulse **RTM 2** will check if the number of hits taken is equal to the entry, **Number of Repeated Shots.** If equal **RTM 2** will not re-arm the impulse

source, if less **RTM 2** will re-arm the impulse source. To unarm the impulse source, toggle **Input 2** to manually fire and unarm the impulse source.

The **RTM 1** recorder unit receives the HIT message and outputs the TIME BREAK signal on the **Output 1** line. The signal polarity is set by the software entry in the RTM program.

Note: The TIME BREAK pulse on the **RTM 1 Output 1** line is delayed 10 msec after the HIT occurred at the impulse unit **RTM 2.**

If the HIT does not occur during the period of time defined by the Time Out entry (5-30 seconds) the process is STOPPED.



Impulse Unit Starts Recorder – FAST Mode

Set mode of the Impulse Source, RTM units to Weight Drop Fast (14h) and the Recorder RTM unit to Weight Drop Encoder (13h)
The RTM unit located at the impulse source is named **RTM 1** and another RTM unit located at the recorder is named **RTM 2** to simplify this manual.

RTM 1 signals:

Input 1 – Hammer hit
Input 2 – Initiate firing sequence
Input 3 – Not used. Set Switch SW3.3=ON (Always Ready)
Output 1 – Not used
Output 2 – Not used

RTM 2 signals:

Input 1 – Not used
Input 2 – Not used
Output 1 – Confirmation Time Break
Output 2 – Not used

Operation:
The impulse unit, **RTM 1,** is started by a signal on the **Input 2** line. The signal polarity is set by software entry in the RTM program.

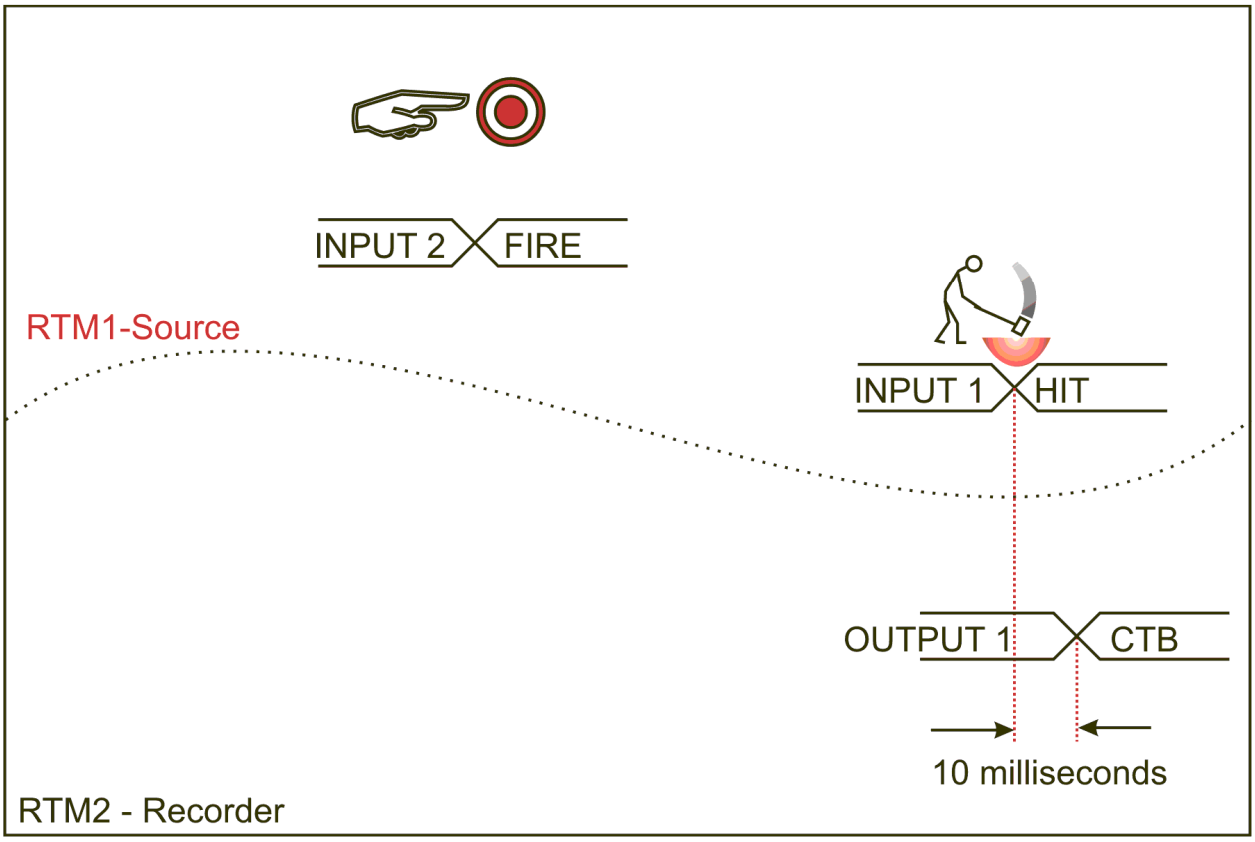
The impulse unit, **RTM 1,** outputs a 2500 Hz tone on a VHF radio and waits for the HIT signal on the **Input 1** line. The signal polarity is set by the software entry in the RTM program.

When HIT occurs the impulse unit, **RTM 1,** outputs the HIT message on the VHF radio. The impulse unit, **RTM 1,** will wait for the HIT to occur the amount of time in the **Time Out** entry.

The recorder unit, **RTM 2,** receives the HIT message and outputs the CONFIRMATION TIME BREAK pulse on the **Output 1** line. The signal polarity is set by the software entry in the RTM program.

If the HIT does not occur during the period of time defined by the Time Out entry (5-30 seconds) the process is STOPPED.

Note: The CONFIRMATION TIME BREAK pulse on the **RTM 2 Output 1** line is delayed 10 msec after the HIT occurred at the impulse unit, **RTM 1.**


INPUT 2
FIRE
RTM1-Source
INPUT 1
HIT
OUTPUT 1
CTB
10 milliseconds
RTM2 - Recorder

Impulse Unit Starts Recorder – Rapid Fire (AUTO-FIRE) Mode

Set RTM Mode to Weight Drop Automatic (10h) and *SW3 switch 1 set to ON* for one RTM and Weight Drop Encoder (13h) for the other RTM. SW3 switch 1 set to ON forces the RTM to be in Automatic (Rapid Fire) mode. The RTM in Automatic (Rapid Fire) mode is located at the impulse source (**RTM 1**) and Mode Encoder at the Recorder (**RTM2**)
Names **RTM 1** and **RTM 2** are used only to simplify this manual.

RTM1 signals:

Input 1 – Hammer hit
Input 2 – Arm-Fire button
Input 3 – Signal from WDC when ready for new cycle.
Input 4 – Signal from Base Plate Up switch
Output 1 – Signal 1 millisecond after hit occurred
Output 2 – Fire pulse to WDC
Output 3 – Arm pulse to WDC not used

RTM2 signals:

Input 1 – Not used
Input 2 – Not used
Output 1 – Confirmation Time Break
Output 2 – Starts recording system

***Operation*:**
The impulse unit, **RTM 1,** cycle is started by a signal on **Input 2**. The signal polarity is set by software entry in the RTM program. The signal source is a mechanical limit switch, proximity sensor or push button. In Auto Mode, toggling the **Input 2** line causes **RTM 1** to arm the Impulse unit. Then **RTM 1** waits for the Impulse unit to be armed. After the Impulse Unit is Ready, **RTM 1,** will start the firing cycle automatically**.**

The **RTM 1** keys up the VHF radio and sends a 2500 Hz tone. The 2500 Hz tone will last the duration of the entry **Weight Drop Start Delay**. At the end of the **Weight Drop Start Delay,** the **RTM 1** located at the impulse source sends out the READY MESSAGE to the **RTM 2** unit located at recorder. If the READY MESSAGE TYPE is set to NONE, the Ready Message will not be sent to RTM2. This selection will cause the fire command to be issued sooner.

The **RTM 2** at the recorder receives the READY MESSAGE and issues a signal on the **Output 2** line. The signal polarity is set by software entry in the RTM program. This signal can be wired to the recorder ARM input, to enable the recording system for the following shot. At the same time the **RTM 2** will output the READY MESSAGE on the serial bus.

The impulse unit, **RTM 1,** starts transmitting the 2500 Hz tone on the radio. After the **FIRE Delay (PTT Delay)** entry time, **RTM 1** outputs a pulse on the **Output 2** line. The signal polarity is set by software entry in the RTM program. This signal is used to start an impulse unit.

The impulse unit, **RTM 1**, waits for the ready line to go inactive in Rapid Fire mode. After the ready line goes inactive the hit detection delay entry is put into place before looking for a hit signal. The impulse unit, **RTM 1,** waits for the HIT signal on the **Input 1** line. The signal polarity is set by software entry in the RTM program. The signal can be provided by hammer switch, limit switch, etc. When the HIT occurs, the impulse unit, **RTM 1,** outputs the HIT message on the VHF radio. The impulse unit **RTM1** will wait for the HIT to occur within the amount of time in the **Time Out** entry (**Time Out** in Rapid Fire needs to be 10 seconds). After the Hit Message is sent or the Time Out period is over, the post report is sent.

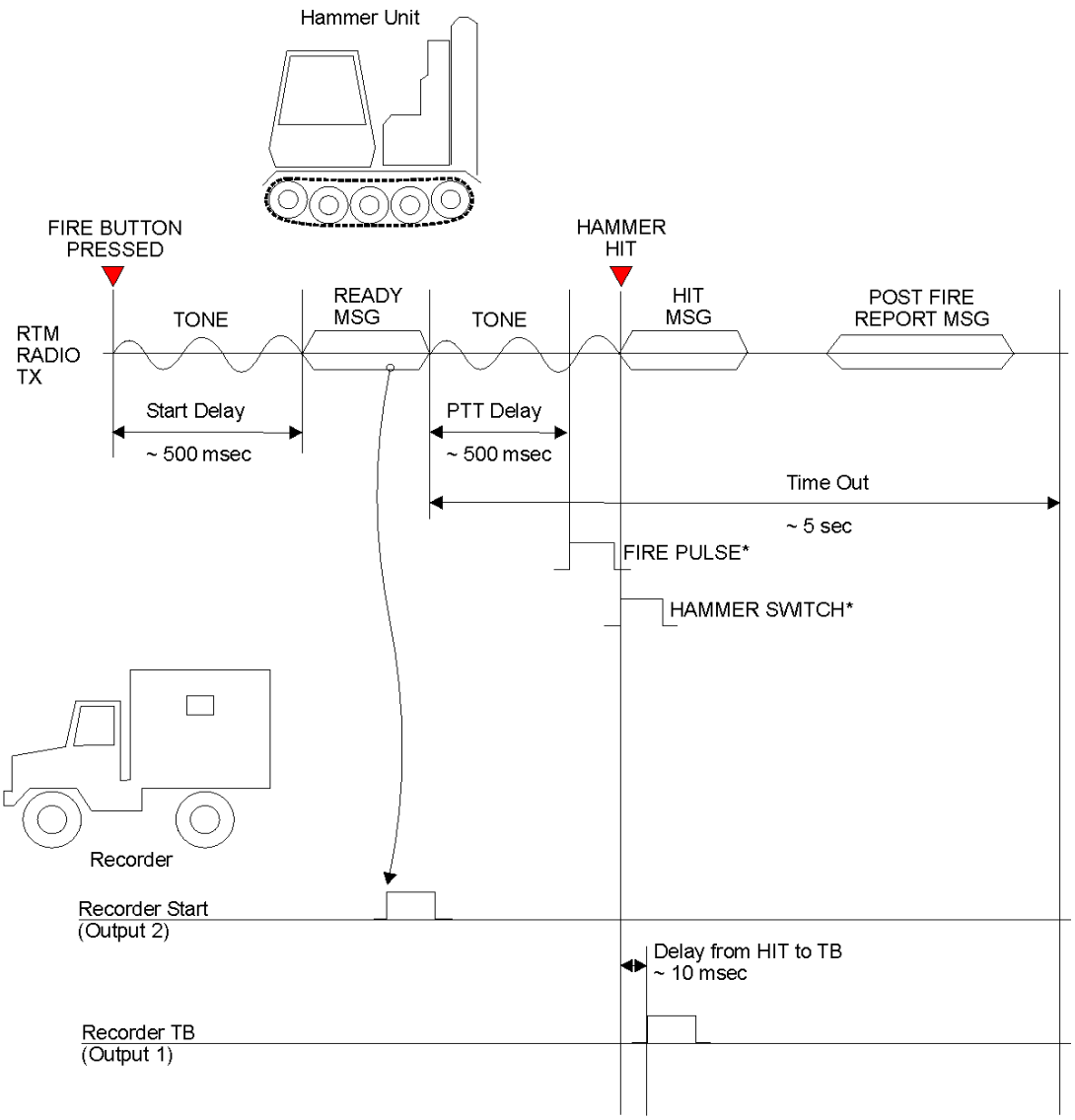
The recorder unit, **RTM 2,** receives the HIT message and outputs the CONFIRMATION TIME BREAK signal on the **Output 1** line. The signal polarity is set by the software entry in the RTM program.
Note: The CONFIRMATION TIME BREAK pulse on the **RTM 2 Output 1** line is delayed 10 msec after the HIT occurred at the impulse unit **RTM 1.** After **RTM 2** receives the post report message the information is sent to the computer and RTI ports.

The Impulse Unit, **RTM 1,** waits for the entered **Cycle Time,** then **RTM 1** checks if the number of hits taken is equal to the entry **Number of Repeated Shots.** If equal, the fire process is stopped. If less, then **RTM 1** sends the arm command to arm the Impulse Unit and the fire cycle is continued. **Set cycle time to 1 for Rapid Fire Mode.**

If the hit does not occur during the period of time defined by the **Time Out** entry, **RTM 1** will arm the Impulse Unit but will not increment the shot counter. The Fire Cycle will continue. **Set Time Out Entry to 10 for Rapid Fire Mode.**

To stop RTM firing cycle, raise the Base Plate UP momentary or Power cycle RTM.
The **RTM 1** will re-set the shot counter and stop the fire cycle.

The AUTO-FIRE Ver. 5 the RTM board is inside the control panel.



NOTE: Polarity of the signals FIRE, HAMMER SWITCH, RECORDER START and RECORDER TB is software selectable.

RTM Timing in the Manual Mode (11h)

RTM GPS

The RTM unit can receive the GPS strings: $GPGGA, $GPGSA, $GPGGK, $GPRMC.

The data has to come in pin 3 and ground on pin 1 of the 25-pin connector. The GPS receiver needs to be configured at 19200-BAUD, no parity, 8 data bits, and 1 stop bit.

Every 20 seconds the RTM unit stores a position to be used in the ready and hit messages.

The position from the ready and hit messages can be displayed in the GPSview program. The BBview program will display which RTM unit is connected to the impulse source and if a position was acquired.

Display Messages

The RTM module has various display messages that show the progress or errors of the weight drop system. The display message definitions are explained below.

Power ON message: DEC 110c RLY 003
ID01 CRW001 SC01

Modes:

ENC – Encoder
DEC – Decoder
AUT – Automatic
RFr – Rapid Fire
MAN – Manual
FST – Fast
110c – The RTM firmware version is 110c.
003 – The Relay board firmware version is 3.
RTM ID is 1
Crew ID is 1
Start Code is 1.

Ready to Fire – ???/??? msec

Unit is ready to fire. If in Automatic mode the amount of hits taken and desired amount to take is displayed. Also the amount of time taken between the fire command issued and the actual hit occurring from the previous hit.

HIT – ???/??? msec

The weight drop has fired and the hammer switch triggered the RTM. If in Automatic mode the amount of hits taken and desired amount to take is displayed. Also the amount of time taken between the fire command issued and the actual hit occurring.

No HIT

The weight drop time out entry has timed out without receiving the hammer switch trigger.

FIRE COMMAND DETECTED

The relay board has detected the fire command from the RTM unit.

Waiting on Baseplate

After the weight drop unit has been cocked, the relay board waits for the baseplate sensor to go good before issuing the ready to fire signal to the RTM unit.

UP Sensor Timed Out

The relay board waits 15 seconds during the hammer cocking sequence for the arming mechanism to reach the top of the mast. If this time is exceeded the UP sensor time out message is displayed.

Down Sensor Timed Out

The relay board waits 15 seconds during the hammer cocking sequence for the arming mechanism to reach the bottom of the mast. If this time is exceeded the Down Sensor time out message is displayed.

Baseplate Sensor Timed Out

When the weight drop unit is armed and ready to fire, if the baseplate sensor goes off because the baseplate comes up the baseplate sensor times out.

ARM CANCELED

The relay board is ready to fire and an ARM command is issued. Then the Arm Canceled display is shown.

RTM II 25-PIN Male CONNECTOR

PIN	FUNCTION
1	**BAT -** - Battery Ground.
2	**TX0 COMPUTER –** RS-232 serial output. Data from RTM to Computer. Connect to COM port of computer running the RTM program. 19200 BAUD.
3	**RX0 COMPUTER** – RS-232 serial input. Data to RTM from Computer. Connect to COM port of computer running the RTM program or GPS receiver. 19200 BAUD.
4	**ISO INPUT 1 ACT** – Isolated input. Isolated Input 1 Active. Recorder remotely starts the RTM in Weight Drop Encoder mode and HIT signal detected in Weight Drop Modes. Isolated with Instrument Amplifier. Polarity selected by software menu.
5	**ISO INPUT 1 RET** - Isolated Input 1 Return.
6	**ISO INPUT 2 ACT** – Isolated input. Isolated Input 2 Active. Used in Weight Drop Modes to start the Weight Drop process. Connected to the start switch. Isolated with 4N32 optocoupler. Polarity selected by software menu.
7	**ISO INPUT 2 RET** – Isolated Input 2 Return.
8	**ISO OUTPUT 1 ACT** – Isolated output. Time Break. Isolated with 4N32 optocoupler. Polarity selected by software menu in Encoder Mode.
9	**ISO OUTPUT 1 RET** – Isolated Output 1 Return.
10	**RS-232** Input at 9600, N, 8, 1. Used by WDC.
11	**ISO OUTPUT 2 ACT** – Isolated Output 2. Recorder start when in Encoder mode. Fire when in Decoder, Manual, or Auto mode. Isolated with 4N32 optocoupler. Polarity selected by software menu.
12	**ISO OUTPUT 2 RET** – Isolated Output 2 Return.
13	**BAT +** - 10-18 volt input.
14	**GPS_PPS**
15	**+5VD** – Output. +5 volts digital.
16	**SPKR_ACT** – Input. Speaker Active to RTM from external radio speaker output. -3.12 volts to +3.04 volts.
17	**SPKR_RET** – Speaker return. Speaker return from external radio speaker return.
18	**PTT_ACT** – Output. Push To Talk Active from RTM to external radio.
19	**RADIO_RET** – Radio return. Radio return from external radio ground.
20	**MIC_ACT** – Output. Microphone Active from RTM to external radio microphone input. - 2.43 volts to + 2.43 volts.
21	**ISO OUTPUT 3 ACT** – Isolated output. ARM on Weight Drop. Uses a 4N32 optocoupler.
22	**ISO OUTPUT 3 RET** – Isolated Output 3 Return.
23	**ISO INPUT** – Isolated Input for baseplate up.
24	**NISO INPUT** – Non-isolated Input for Relay board Ready signal
25	**BAT +** - 10-18 volt input

RTM II 9-PIN Male CONNECTOR

PIN	FUNCTION
2	**RX2 RTI** – RS-232 serial input. Data to RTM from Recording System.
3	**TX2 RTI –** RS-232 serial output. Data from RTM to Recording System.
5	**BAT -** - Battery Ground.
6	Jumper to pin 7 for data to go to Recording System**.**
7	Jumper to pin 6 for data to go to Recording System.

RTM II Generic Encoder Cable (open ended)

RTM-25 to Power

13,25	Battery +
1	Battery -

RTM-25 to DSUB1 –9-pin female

2	2
3	3
1	5

RTM to Analog

4 White	Input 1 Act. isolated	
5 Black	Input 1 Ret.	
8 White	ISO Output 1	CTB Active
9 Black	ISO Output 1 return	CTB Return
11 White	ISO Output 2	ARM Active
12 Black	ISO Output 2 return	ARM Return

Radio

20 White	Mic Act
19 BLK	Radio Return
18	PTT Active
16 White	Speaker Active
17 BLK	Speaker Return

5 pin Radio Cable Wiring

Mic Active –	A
Radio Return -	C
Speaker Act-	B
Speaker Ret-	E
PTT	D

RTM II Generic Decoder Cable (open ended)

RTM-25 to Power

13,25	Battery +
1	Battery -

RTM to Analog

4 White	Input 1 Act. Non-Isolated	Hammer switch +
5 Black	Input 1 Ret.	Hammer switch -
6 White	Input 2 Act. Isolated	Arm-Fire button +
7 Black	Input 2 Ret.	Arm-Fire button -
8 White	ISO Output 1 Isolated	Arm Active
9 Black	ISO Output 1 return	Arm Return
11 White	ISO Output 2 Isolated	Fire Active
12 Black	ISO Output 2 Return	Fire Return

Radio

20 White	Mic Act
19 BLK	Radio Return
18	PTT Active
16 White	Speaker Active
17 BLK	Speaker Return

5 pin Radio Cable Wiring

Mic Active –	A
Radio Return -	C
Speaker Act-	B
Speaker Ret-	E
PTT	D

RTM II Programming Cable

RTM-25	to	Power
13,25		Battery +
1		Battery -

RTM-25	to	DSUB1 –9-pin female
2		2
3		3
1		5

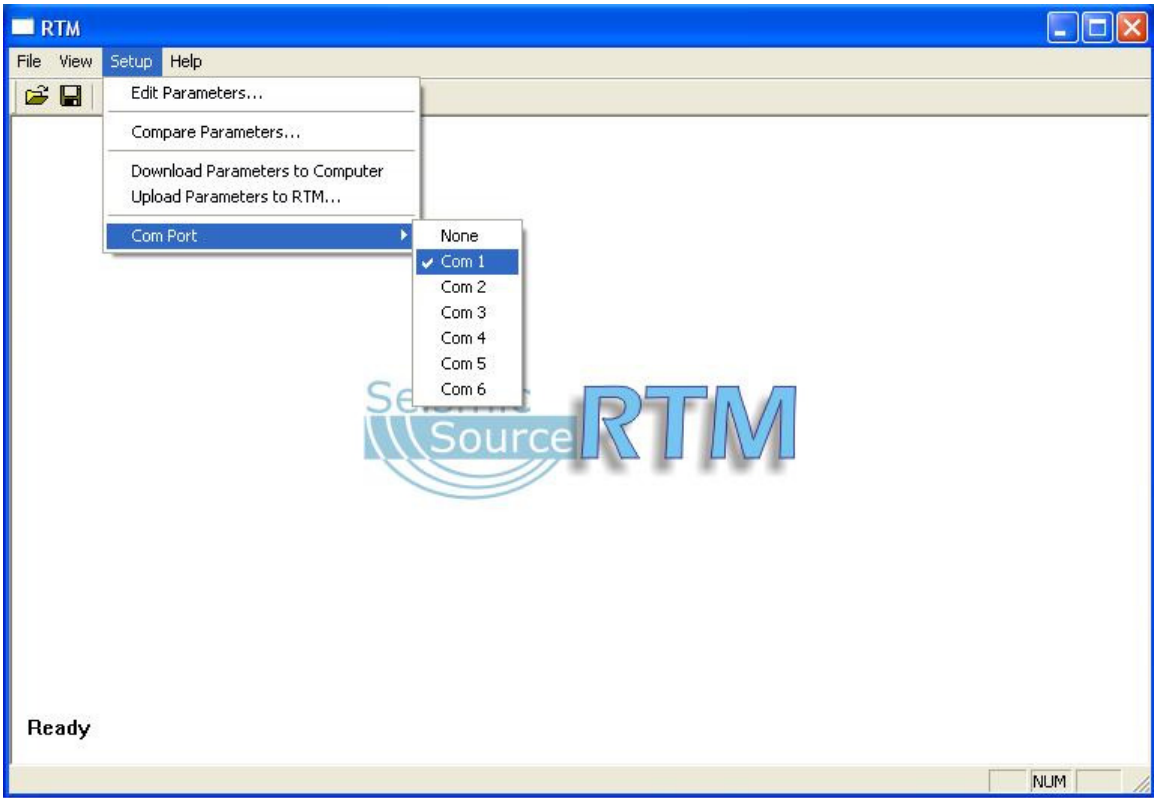
Computer Software

RTM Ver. 12 Operation

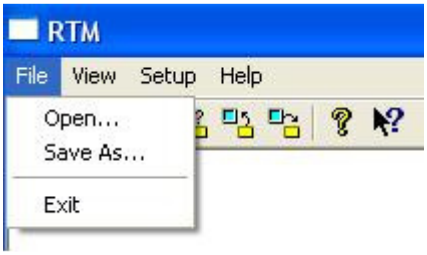
The RTM program allows the user to access all the features of the RTM system.

RTM: Operates on a personal computer running with a Microsoft Windows™ 2000, NT, and XP operating system.

- The serial port of the computer is connected to COM 0 of the RTM Unit
- Start the RTM program on the computer.
- Select correct COM port on the computer
    - Setup
        - Com Port
            - Select COM port used

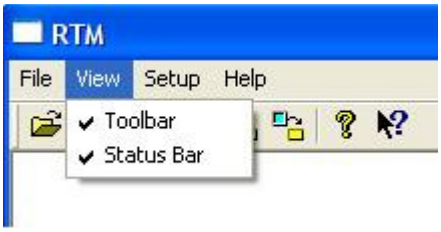


File Menu



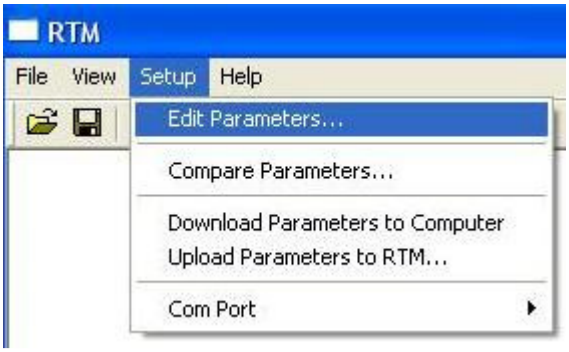
- **Open –** Opens a Saved File
- **Save As –** Saves Current File

View Menu



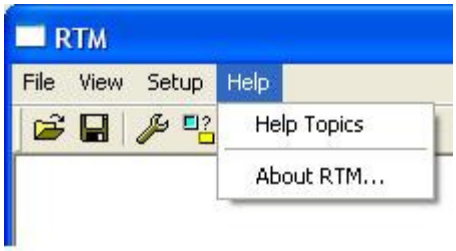
- Add or Remove check marks to display Functions

Setup Menu



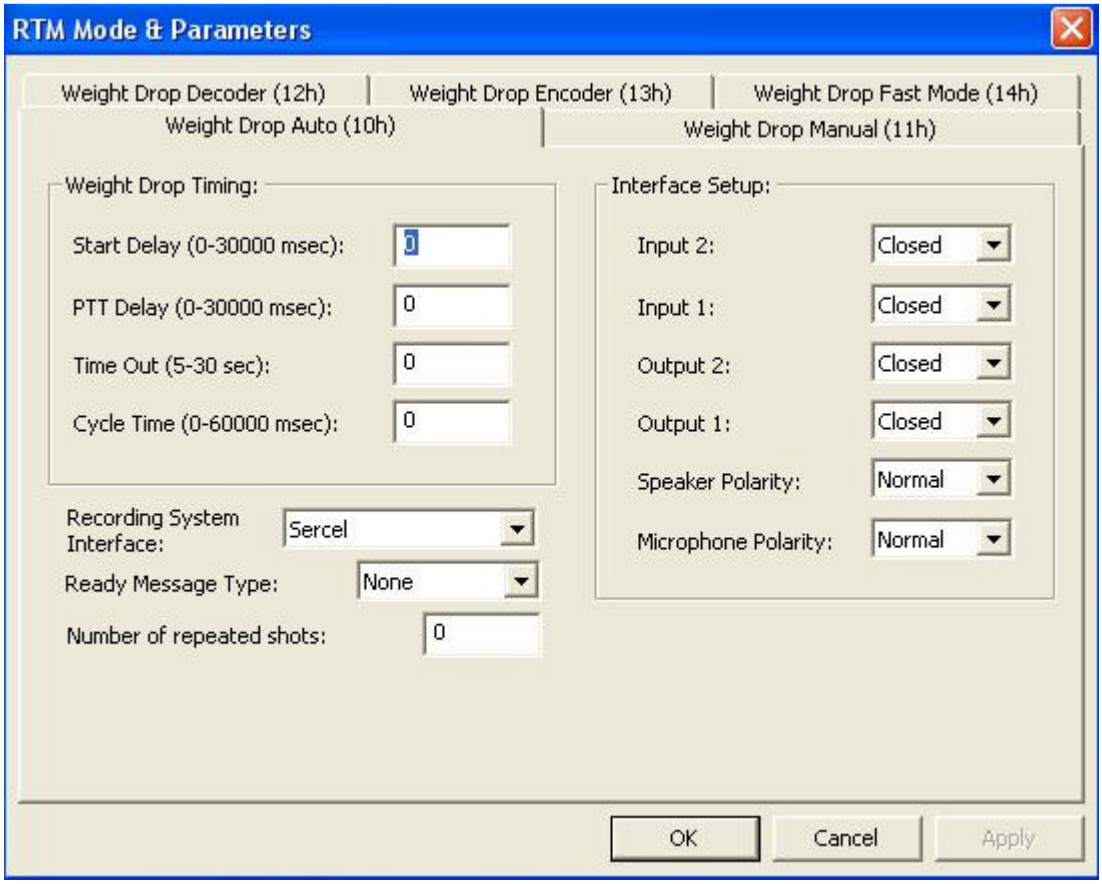
- **Edit Parameters –** Allows entry and editing of all RTM operation parameters.
- **Compare Parameters –** This compares the parameters in the RTM to the parameters in the RTM computer program.
- **Download Parameters to Computer -** Receives parameters from RTM into the Computer
- **Upload Parameters to RTM -** Sends the Parameters to the RTM
- **Com Port -** The serial port of the computer is connected to COM 0 of the RTM

Help Menu



- **Help Topics –** Application Help
- **About RTM -** Shows Version of RTM and Contact Info

Weight Drop Auto



Weight Drop Timing

- **Start Delay** - Time from starting pulse till ready message sent to Encoder for pre-start
- **FIRE Delay (PTT Delay) –** Time from ready message before sending fire command
- **Time Out –** Length of time to wait for hit signal before stopping the cycle
- **Cycle Time –** Length of time to wait after the hit signal before re-starting the cycle in automatic mode

Interface Setup

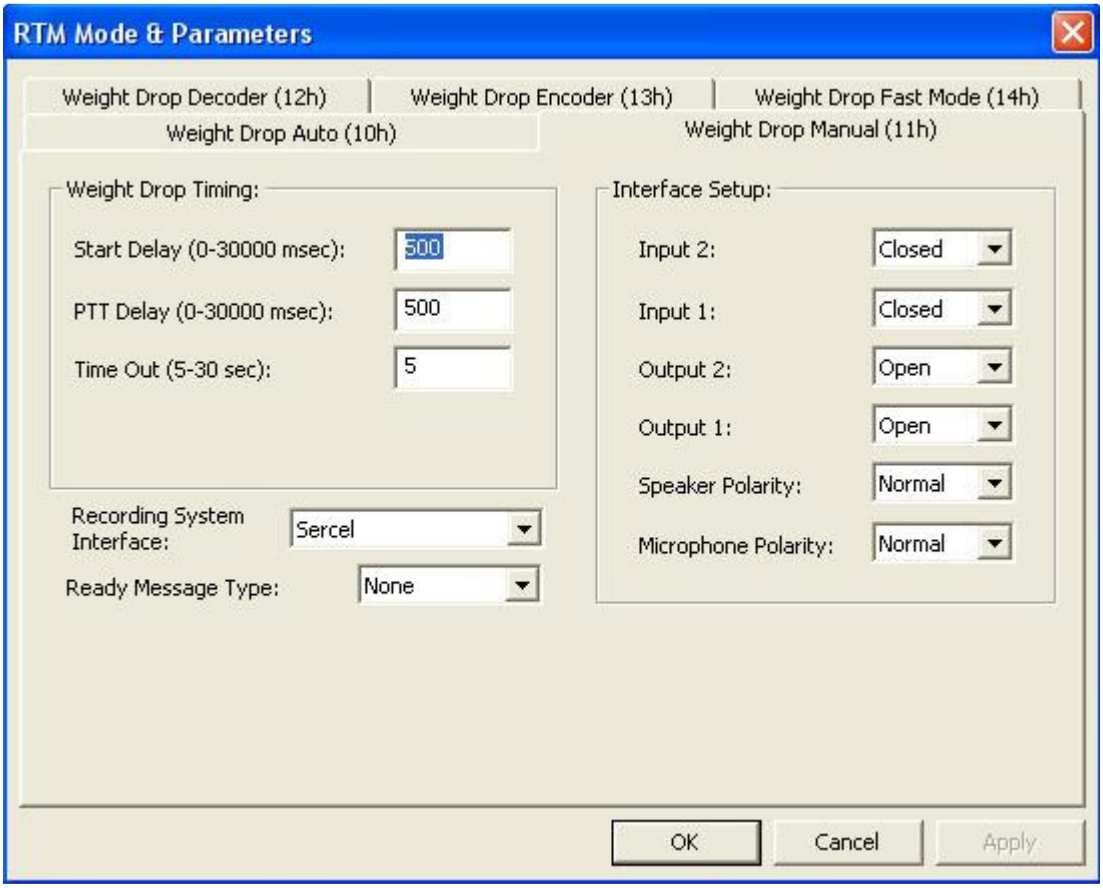
- **Input 2 –**High = Opto Active Open
- **Input 1 –** Active state of Opto
- **Output 2 –**Low = Opto Active Closed
- **Output 1 –** Active state of Opto
- **Speaker Polarity –** Select same speaker polarity on RTM.
- **Microphone Polarity –** Select same microphone polarity on RTM

Recording System: Set Recorder type according to Recorder connected. Sercel for Sercel Recorders. Generic 9600 for I/O Recorders. Generic 9600 for Geo-X Recorders.

Ready Message: Compatible with Boom Box, Advance 2, VibPro

Number of Repeated Shots: Number of shots the RTM will take before stopping in Automatic Mode

Weight Drop Manual



Weight Drop Timing

- **Start Delay** - Time from starting pulse till ready message sent to Encoder for pre-start
- **FIRE Delay –** Time from ready message before sending fire command
- **Time Out –** Length of time to wait for hit signal before stopping the cycle

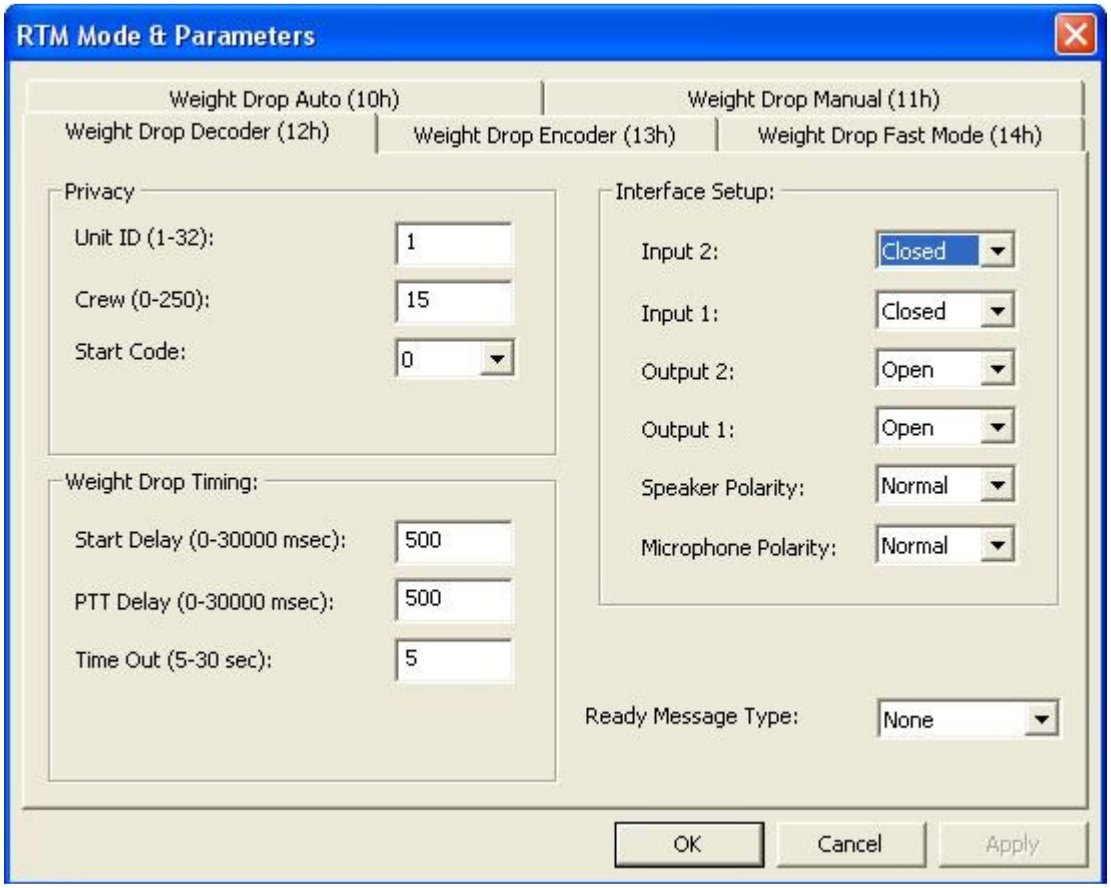
Interface Setup

- **Input 2 –**High = Opto Active Open
- **Input 1 –** Active state of Opto
- **Output 2 –** Low = Opto Active Closed
- **Output 1 –** Active state of Opto
- **Speaker Polarity –** Select same speaker polarity on RTM.
- **Microphone Polarity -** Select same microphone polarity on RTM

Recording System Interface: Set Recorder type according to Recorder connected. Sercel for Sercel Recorders. Generic 9600 for I/O Recorders. Generic 9600 for Geo-X Recorders.

Ready Message Type: Compatible with Boom Box, Advance 2, VibPro

Weight Drop Decoder



Privacy

- **Unit ID –** Select the Unit ID of the Encoder Box
- **Crew Code –** The Crew Code of the Encoder must match the Crew Code of the Decoder
- **Start Code –** The Start Code of the Encoder must match the Start Code of the Decoder

Interface Setup

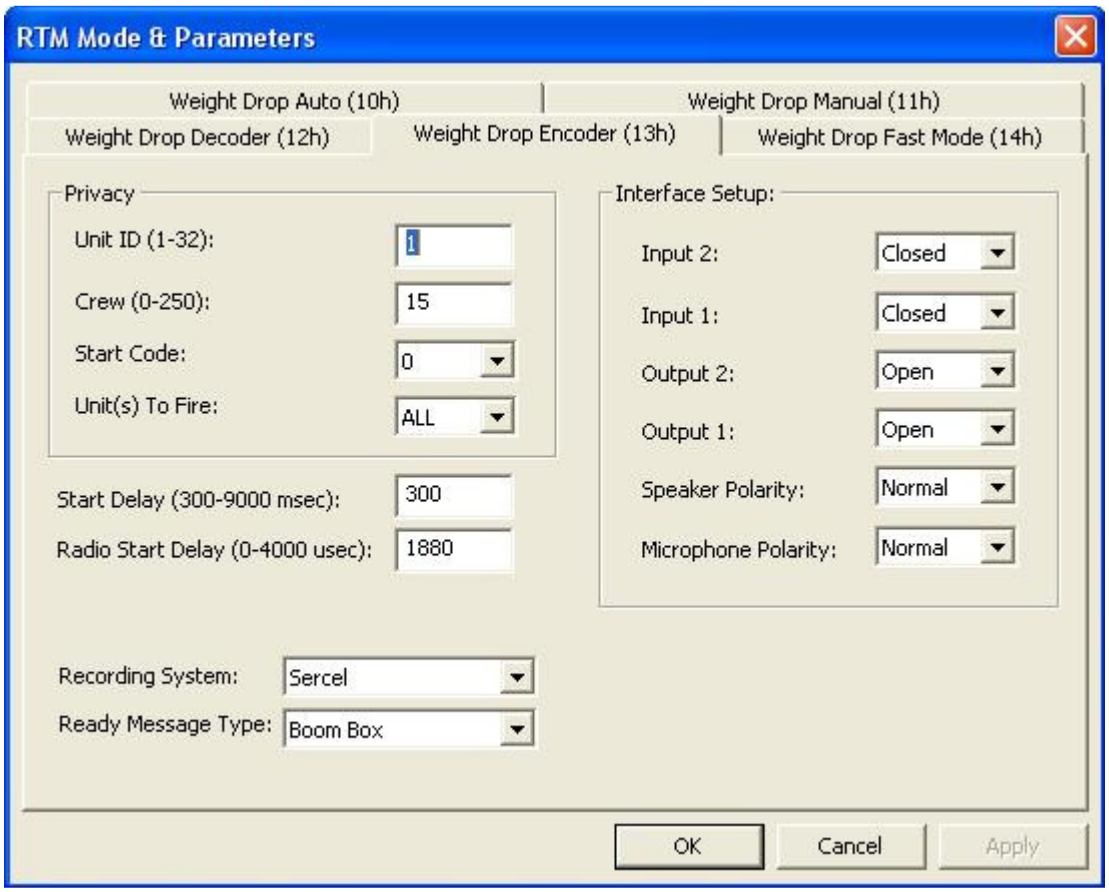
- **Input 2 –**High = Opto Active Open
- **Input 1 –** Active state of Opto
- **Output 2 –** Low = Opto Active Closed
- **Output 1 –** Active state of Opto
- **Speaker Polarity –** Select same speaker polarity on RTM.
- **Microphone Polarity -** Select same microphone polarity on RTM

Weight Drop Timing

- **Start Delay** – Time from starting pulse till ready message sent to Encoder for pre-start
- **FIRE Delay** - Time from ready message before sending fire command
- **Time Out -** Length of time to wait for hit signal before stopping the cycle

Ready Message Type: Compatible with Boom Box, Advance 2, VibPro

Weight Drop Encoder



Privacy

- **Unit ID –** Select the Unit ID of the Encoder Box
- **Crew Code –** The Crew Code of the Encoder must match the Crew Code of the Decoder
- **Start Code –** The Start Code of the Encoder must match the Start Code of the Decoder
- **Units to Fire –** Select which RTM's are to fire

Interface Setup

- **Input 2 –**Active state of Opto
- **Input 1 –** High = Opto Active Open (Recorder Starts RTM)
- **Output 2 –**High = Opto Active Open (RTM Starts Recorder)
- **Output 1 –** High = Opto Active Open (Time Break)
- **Speaker Polarity –** Select same speaker polarity on RTM.
- **Microphone Polarity –** Select same microphone polarity on RTM

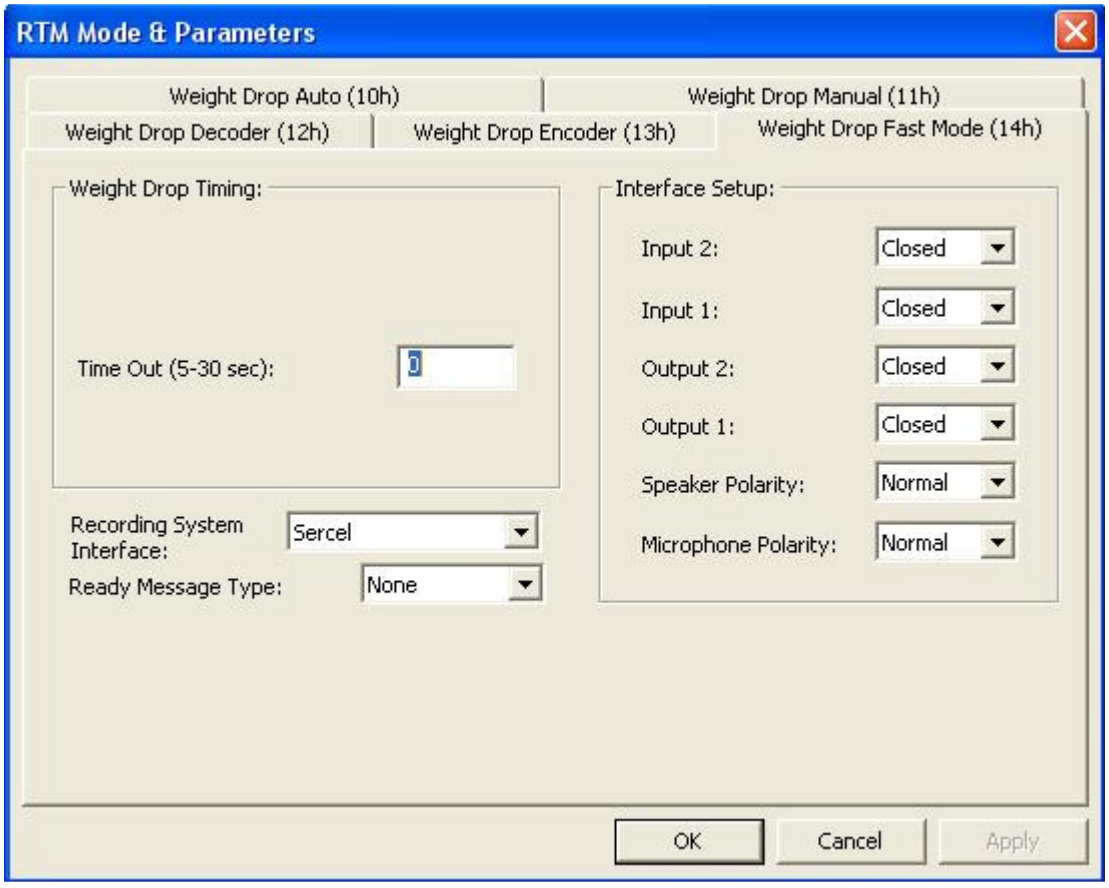
Start Delay: Time from recording system starting RTM encoder and fire command issued at decoder RTM.

Radio Start Delay: The RTM system automatically monitors the two-way radio start delay and verifies that it is within the desired limits

Recording System: Set Recorder type according to Recorder connected. Sercel for Sercel Recorders. Generic 9600 for I/O Recorders. Generic 9600 for Geo-X Recorders

Ready Message Type: Compatible with Boom Box, Advance 2, VibPro

Weight Drop Fast Mode



Weight Drop Timing

- **Time Out –** Length of time to wait for hit signal before stopping the cycle

Interface Setup

- **Input 2 –**High = Opto Active Open
- **Input 1 –** Active state of Opto
- **Output 2 –** Low = Opto Active Closed
- **Output 1 –** Active state of Opto
- **Speaker Polarity –** Select same speaker polarity on RTM.

Recording System Interface: Set Recorder type according to Recorder connected. Sercel for Sercel Recorders. Generic 9600 for I/O Recorders. Generic 9600 for Geo-X Recorders

Ready Message Type: Compatible with Boom Box, Advance 2, VibPro

RTM Entries

WD ENCODER 0x13

Start Delay – (300-9000ms)

- Time prior to sending radio Start Code message

Radio Start Delay – (0-4000 microseconds)

- Adjustable time for sending radio Start Code message
- Mainly useful when time break is consistent (dynamite), not much use when time break isn't consistent (weight drop).

WEIGHT DROP CONTROLLER – Auto (0x10), Decoder (0x12), Manual (0x11), and Fast Mode (0x14)

Start Delay

- Time from start of fire sequence (Arm/Fire or radio Start Code) till pre-start radio Ready Message sent.
- If Encoder is not consistently receiving the pre-start radio Ready Message, increase this entry.
- Timing of this entry is the entered value and 204 milliseconds (internal).
- Ready Message Type set to NONE, this entry is bypassed.

PTT (FIRE) Delay

- Time from pre-start radio Ready Message sent till FIRE command is issued to weight drop controller.
- Radio key up and tone begin 484 milliseconds after Start Delay.
- If the Encoder doesn't consistently receive the Hit radio message (Time Break), increase this entry.
- Timing of this entry is the entered value and 500 milliseconds (internal).

Time Out

- Time to wait after Fire command is issued for the Hit signal.

Cycle Time (0-60000 ms)

- Time after Time Out entry or after radio post report is sent till re-starting fire sequence in Auto mode.
- Non-Auto-Fire weight drop
    - >= 4, Wait after radio post report sent and this entry time before ARM command is sent in Auto mode.
    - <4, ARM command is sent after Hit is detected in Auto mode
- Auto-Fire weight drop
    - >= 4
- Zero, No Hit is detected in Auto mode, Auto mode is stopped.
- Decoder mode (0x12), after Fire sequence waits this entry value before allowing Arm Command to be sent.

Ready Message Type

- NONE, Bypass Start Delay, pre-start radio ready message, in Fire sequence. Quicker turnaround.
- Boom, sends pre-start radio ready message in Fire sequence.

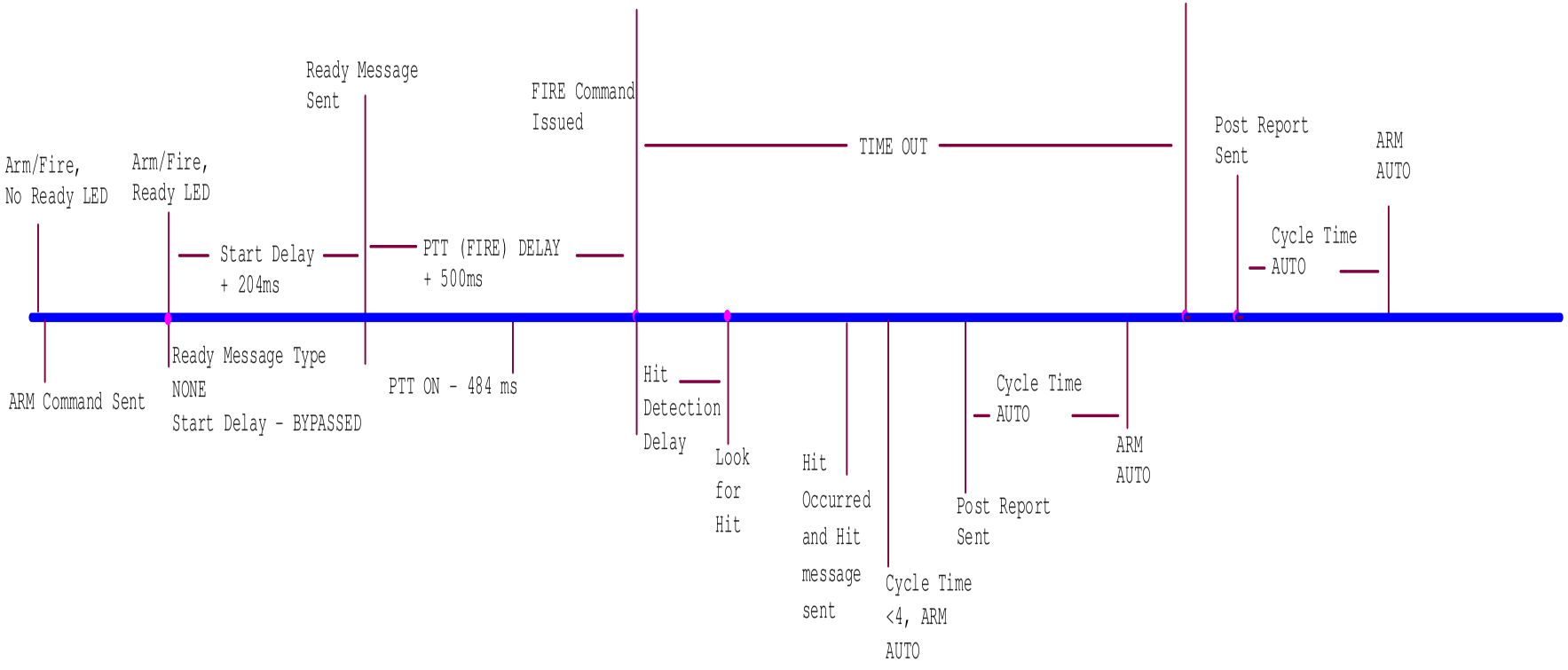
Number of Repeated Shots

- Number of shots to take in Auto mode
- Decoder mode (0x12) starting fire sequence with radio start code, entry is the number of hits to re-arm.

Hit Detection Delay

- Time to wait after Fire command is issued before looking for Hit signal.

	Encoder	Weight Drop	Software selectable Y/N
Input 1	Remote Start	Hit Signal	Y
Input 2		Arm/Fire	Y
Output 1	Time Break	Time Break closure	Y
Output 2	Pre-Start	FIRE	Y
Output 3		ARM	N


Arm/Fire,
No Ready LED
Arm/Fire,
Ready LED
Start Delay
+ 204ms
Ready Message
Sent
PTT (FIRE) DELAY
+ 500ms
FIRE Command
Issued
TIME OUT
Post Report
Sent
ARM
AUTO
Cycle Time
AUTO
ARM Command Sent
Ready Message Type
NONE
Start Delay - BYPASSED
PTT ON - 484 ms
Hit
Detection
Delay
Look
for
Hit
Hit
Occurred
and Hit
message
sent
Cycle Time
<4, ARM
AUTO
Post Report
Sent
Cycle Time
AUTO
ARM
AUTO