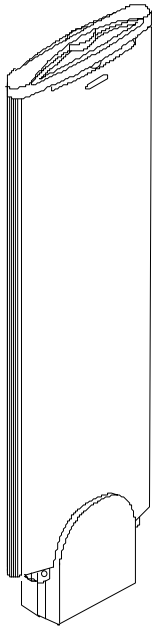
Ultra•Post™ EAS Detector

ZAUPMH Ultra•Post Master (Switched Mode Transmitter)

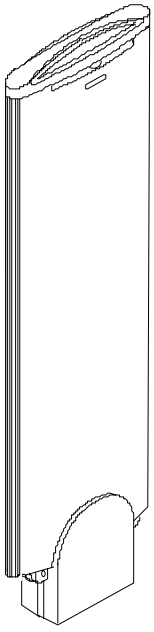
ZAUPSH Ultra•Post Secondary (Switched Mode Transmitter)

ZAUPML Ultra•Post Master (LPA Transmitter)

ZAUPSL Ultra•Post Secondary (LPA Transmitter)



Primary Pedestal w/Alarm



Secondary Pedestal

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About this Guide

This reference guide explains the transmitter theory for both the LPA and switched mode transmitter theory for the Ultra•Post® Detector. Other related documents are:

- Planning Guide (LPA Transmitter), 8000-2595-02
- Planning Guide (Switched Mode Transmitter), 8000-2595-03
- Installation Guide (LPA Transmitter), 8000-2595-04
- Installation Guide (Switched Mode Transmitter), 8000-2595-05
- Setup and Service Guide (LPA Transmitter), 8000-2595-06
- Setup and Service Guide (Switched Mode Transmitter), 8000-2595-07

Note: Because placement of detector components depends on architectural and customer requirements, your Sensormatic representative will supply this information separately.

If you need assistance...

Call Sensormatic Customer Support at:

1-800-543-9740

(DOJ) 10/98

Detector Boards

The primary pedestal (Figure 1) contains three boards:

- LPA transmitter board (0301-0784-01) or switched-mode transmitter board (0301-0791-01)
- Receiver/controller board (0301-0785-01)
- Alarm board (0301-0810-01).

The secondary pedestal contains an LPA transmitter tuner board (0301-0812-01) or switched-mode transmitter tuner board—0301-0816-01). The ranger antenna contains a ferrite receiver board (0301-0396-02).

LPA Transmitter Board

Used primarily to meet emissions regulations in Europe, this board:

- Generates operating +12Vdc, –12Vdc, +5Vdc for the detector (logic supply). The +12Vdc line also powers the pedestal's cooling fan.
- Supplies current through low distortion linear power amplifiers to the antenna coils and has jumpers to facilitate tuning.

Switched Mode Transmitter Board

Used primarily for non-European applications, this board:

- Generates operating +12Vdc, –12Vdc, +5Vdc for the detector (logic supply). The +12Vdc line also powers the pedestal's cooling fan.
- Supplies current through a high current switching transmitter to the antenna coils and has jumpers to facilitate tuning.

Receiver/Controller Board

This board has two sections: a receiver section and a controller section.

- The receiver section conditions incoming signals for analysis by the controller section.
- The controller section:
  - Controls detector timing and analyzes incoming signals for the presence of a tag.
  - Switches receiver inputs to either the primary or secondary antennas and disconnects the receiver during transmission.

- Generates inputs to the alarm board.
- Contains LEDs that indicate routine operation and error conditions.

This section's main components are a field programmable gate array (FPGA) and a microcontroller.

Alarm Board

This board provides an audio/visual warning that an alarm condition occurred during routine operation. This board consists of:

- A ring of 14 alarm LEDs that light in one of three alarm patterns
- Audio (2 buzzers) with volume control accessible through the bottom of the board (pedestal front cover must be removed)
- Power interrupt "dying gasp" alarm feature with enable/disable jumper JW1 accessible on bottom of board. Install the jumper to enable.
- Transmit inhibit switch S1 accessible via a small hole in the top cap of the pedestal
- Power on and transmit/alarm disable LED indicator.

Figure 1. Primary pedestal overview

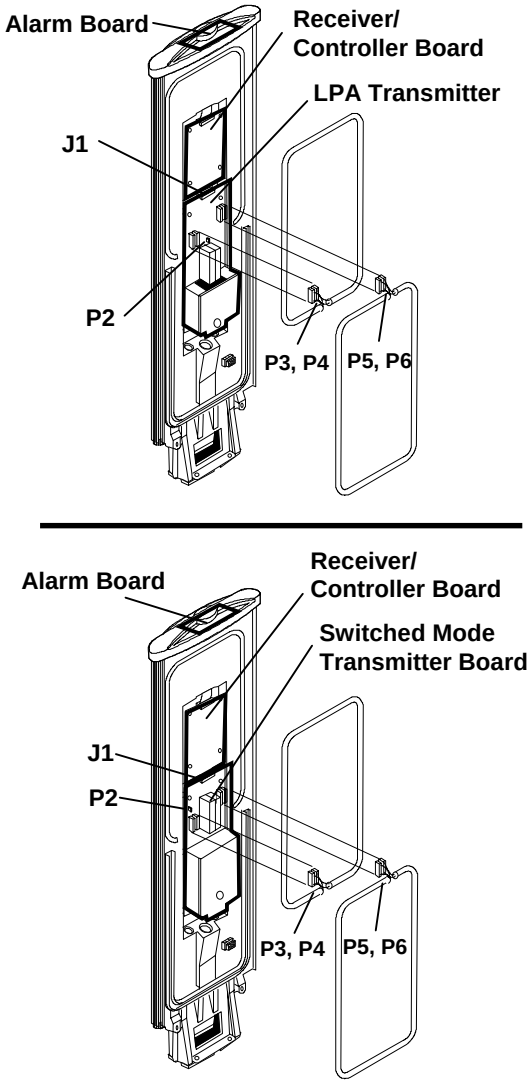


Figure 1 (continued) LPA transmitter

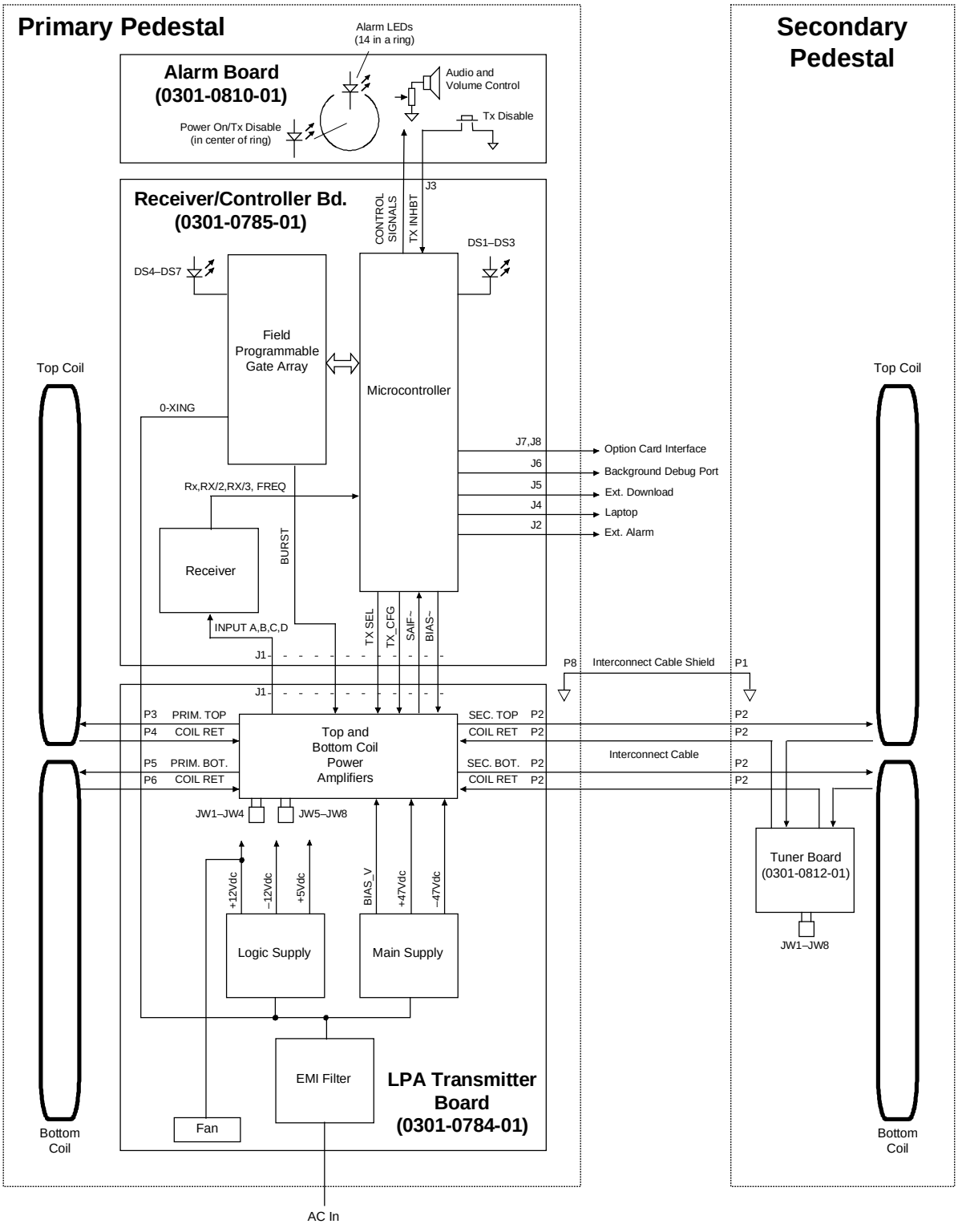
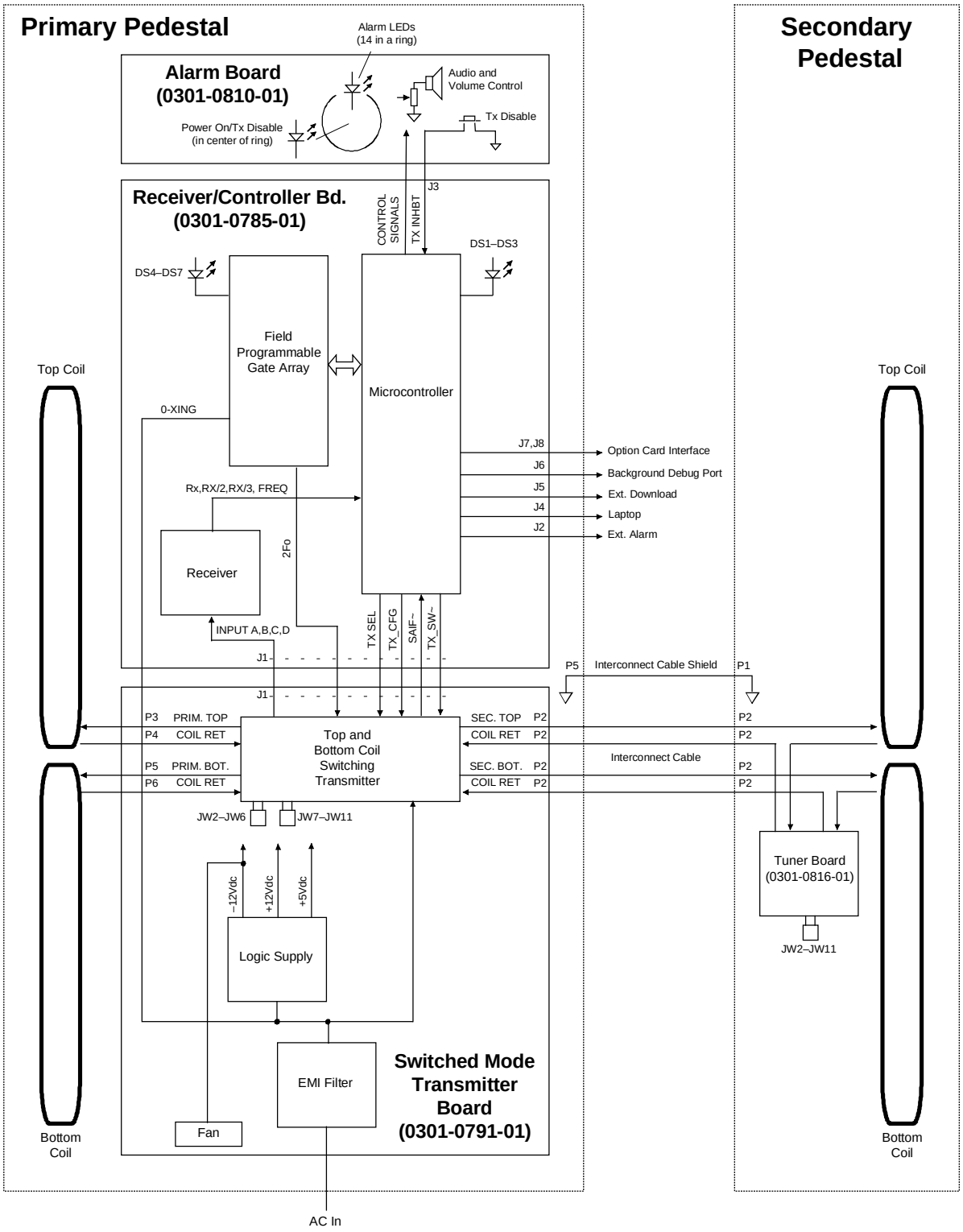


Figure 1 (continued) Switched mode transmitter



Power Up Sequence

The detector performs a Power On Self Test upon power up or hardware reset. If the detector completes this test, all LEDs on the receiver/controller board flash five or six times: five times to indicate 50Hz power line frequency, six times to indicate 60Hz power line frequency. This may take 6 to 8 seconds.

Error Codes

If the detector did not pass the power up self test, then the red LED DS3 should indicate an error code. Error codes are as follows:

11	Memory test failure- Fatal Error
12	FPGA load failure- Run Time Error
13	EPROM xsum- Fatal Error
14	NVM test- Run Time Error
15	No line sync- Run Time Error
21	Line frequency out of tolerance- Run Time Error
22	Calibration test failure- Run Time Error
23	Hot Supply Code - power supply too hot
24	Tx Time Out Code - transmitter on too long
25	Supply Cool Code - supply was hot-now cooled down
31	Primary Tx current upper coil failure- Run Time Error
32	Primary Tx current lower coil failure- Run Time Error
33	Secondary Tx current upper coil failure- Run Time Error
34	Secondary Tx current lower coil failure- Run Time Error

To indicate an error code, the DS3 LED will flash a number of times, pause, then flash again a number of times. For example: DS3 flashing three times, pausing, then flashing two times indicates error code 32. Multiple error codes are displayed in sequence.

Note: If a “fatal error” occurs, the detector will lock and only the error code will be displayed.

Detecting the Tag

The unique characteristic of an active Ultra•Max tag is that:

1. Magnetic fields close to the tag’s natural frequency cause it to vibrate or “ring” at the field’s frequency.
2. Once the field is removed, the tag loses this energy by exponentially ringing down at its own natural frequency.

Therefore, the detector detects Ultra•Max tags by transmitting a magnetic field burst, then checking for signals close to the detector’s operating frequency after the burst. If the detector determines that the signals are from a tag, it initiates an audio-visual alarm.

Note: The detector can be set for 58kHz or 60kHz operation. 58kHz operation is described in this manual.

Detection Routine (no tag detected)

The detection routine when no tag is detected is timed to a lookup table in detector memory (Figure 2). The table includes 54 phases, which are composed of 17 cycles of the local power line frequency. The software starts on phase 1, increments the phase count until it reaches phase 54, then loops back to phase 1. The first 48 phases are when the detector transmits and looks for tag signals and noise. The last 6 phases are when the detector does not transmit but instead looks only for noise. These last 6 phases can then be used by nearby Ultra•Post detectors to synchronize their operation upon power up.

Modes of Operation

The table in Figure 2 shows the detection routine (when no tags are detected) for each of the detector’s six modes of operation. Each mode of operation performs as follows:

- **“Primary only”.** In this mode, only the primary pedestal transmits and receives.
- **“Secondary only”.** In this mode, only the secondary pedestal transmits and receives (for diagnostics or tuning only).

- **"Primary/Secondary".** In this mode, both primary and secondary pedestals transmit independently in four sequential phases. The primary pedestal transmits and receives in phase 1, then takes a noise measurement in phase 2. Next, the secondary pedestal transmits and receives on phase 3, then takes a noise measurement in phase 4. The software then loops back to the primary pedestal and the algorithm continues.
- **"Primary/Secondary"** alternating. In phase 1, one pedestal transmits and the opposite pedestal receives. In phase 2, a noise measurement is taken. In phase 3, the transmit and receive pedestals reverse roles.
- **"Primary transmit/Secondary receive".** In this mode, the primary pedestal only transmits and the slave pedestal only receives and takes noise measurements.

  Note: This mode is not recommended for use with the ranger receiver antennas. Use the primary transceiver/ferrite receive mode.
- **"Primary receive/Secondary transmit".** In this mode, the primary pedestal only receives and takes noise measurements and the secondary pedestal only transmits.
- **"Primary transceiver/Ranger antenna".** In this mode, the primary pedestal transmits, receives, and takes noise measurements while the ranger antenna only receives and takes noise measurements.

Transmit Phases and Noise Phases

To detect a tag, each mode of operation goes through a transmit phase where the detector transmits, then waits for an incoming signal (when a tag signal is expected). Then on the next phase, a noise phase (N) occurs, during which the detector uses a rolling average to determine the background noise level (used as a base line for determining the minimum amplitude that a signal must have to be successfully processed by the detector). A separate rolling noise average is maintained for each phase.

Transmit phase. A transmit phase consists of a 1.6ms transmit window and a 1.7ms receive window:

- During the transmit window, the detector transmits a 58kHz magnetic field for 1.6ms.
  - When transmitting, top and bottom antenna coils alternately switch every four line phases between aiding (A) and figure-8 (8) configurations (until an incoming signal is detected). The aiding configuration is more sensitive to horizontal and lateral tag orientations; the figure-8 configuration is more sensitive to the vertical tag orientation.
  - Transmit bursts follow a 45Hz repetition rate when synchronized to 60Hz ac, or follow a 37.5Hz repetition rate when synchronized to 50Hz ac. The transmit burst repetition rate increases to 90Hz (60Hz ac) or 75Hz (50Hz ac) during the tag validation sequence.
  - During the transmit window, the receiver is disconnected (so transmit signals cannot enter the receiver).
  - To broaden the detector's ability to detect tags with slightly different natural frequencies, the transmit burst frequency alternates between 57.8kHz and 58.2kHz every 8 line phases (except for the last six), or until an incoming signal is detected.

Figure 2. Detection routine lookup table

Ultra Post Modes:																											
Primary Only																											
Phase #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Transmit Enable	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N
Transmit Select	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Transmit Configuration	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8
Transmit Frequency	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-
Primary Receive	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On
Secondary Receive	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Secondary Only																											
Phase #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Transmit Enable	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N
Transmit Select	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Transmit Configuration	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8
Transmit Frequency	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-
Primary Receive	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Secondary Receive	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On
Primary/Secondary																											
Phase #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Transmit Enable	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T
Transmit Select	P	S	S	P	P	S	S	P	P	S	S	P	P	S	S	P	P	S	S	P	P	S	S	P	P	S	S
Transmit Configuration	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8
Transmit Frequency	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-
Primary Receive	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off
Secondary Receive	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On
P/S Alternating																											
Phase #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Transmit Enable	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T
Transmit Select	P	S	S	P	P	S	S	P	P	S	S	P	P	S	S	P	P	S	S	P	P	S	S	P	P	S	S
Transmit Configuration	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8
Transmit Frequency	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-
Primary Receive	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On
Secondary Receive	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off
Prim. Tx / Sec. Rx																											
Phase #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Transmit Enable	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N
Transmit Select	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Transmit Configuration	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8
Transmit Frequency	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-
Primary Receive	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Secondary Receive	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On
Prim. Rx / Sec. Tx																											
Phase #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Transmit Enable	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T
Transmit Select	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Transmit Configuration	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8
Transmit Frequency	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-
Primary Receive	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On
Secondary Receive	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Ferrite Setup																											
Phase #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Transmit Enable	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T
Transmit Select	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Transmit Configuration	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8
Transmit Frequency	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-
Primary Receive	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off
Secondary Receive	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On
T- Transmit Phase				N- Noise Phase					± - Frequency Hopping ±200Hz of Operating Frequency																		
A- Aiding Tx				8- Figure 8 Tx																							
P- Primary Tx				S- Secondary Tx																							

																										Ultra Post Modes:
																										Primary Only
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	Phase #
N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	N	N	N	N	N	N	Transmit Enable
P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Transmit Select
A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	8	8	8	Transmit Configuration
-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	Transmit Frequency
On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	Primary Receive
Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Secondary Receive
																										Secondary Only
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	Phase #
N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	N	N	N	N	N	N	Transmit Enable
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	Transmit Select
A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	8	8	8	Transmit Configuration
-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	Transmit Frequency
Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Primary Receive
On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	Secondary Receive
																										Primary/Secondary
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	Phase #
N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	N	N	N	N	N	N	Transmit Enable
P	P	S	S	P	P	S	S	P	P	S	S	P	P	S	S	P	P	S	S	P	P	P	P	P	P	P	Transmit Select
A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	8	8	8	Transmit Configuration
-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	Transmit Frequency
Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Primary Receive
On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	Secondary Receive
																										P/S Alternating
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	Phase #
N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	N	N	N	N	N	N	Transmit Enable
P	P	S	S	P	P	S	S	P	P	S	S	P	P	S	S	P	P	S	S	P	P	P	P	P	P	P	Transmit Select
A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	8	8	8	Transmit Configuration
-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	Transmit Frequency
On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	Primary Receive
Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Secondary Receive
																										Prim. Tx / Sec. Rx
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	Phase #
N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	T	N	N	N	N	N	N	N	N	N	Transmit Enable
P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Transmit Select
A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	8	8	8	Transmit Configuration
-	-	-	-	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	Transmit Frequency
Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Primary Receive
On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	Secondary Receive
																										Prim. Rx / Sec. Tx
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	Phase #
N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	N	N	N	N	N	N	Transmit Enable
S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	Transmit Select
A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	8	8	8	Transmit Configuration
-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	Transmit Frequency
On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	On	Primary Receive
Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Secondary Receive
																										Ferrite Setup
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	Phase #
N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	N	N	N	N	N	N	Transmit Enable
P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Transmit Select
A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	A	A	A	A	8	8	8	8	8	8	8	Transmit Configuration
-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+	+	+	Transmit Frequency
Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Primary Receive
On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	Secondary Receive

- During the receive window, in-band signals picked up by the connected antenna can enter the receiver.
  - A short delay (default: 640µs) between the transmit and receive windows enables the transmitter to fully turn off, ensuring that it won't interfere with the receiver's ability to detect tag ring down. If necessary, use the laptop interface to adjust this delay.
  - When receiving, the top and bottom coils can be set for quadrature or figure-8 configurations. The quadrature configuration is used for routine operation; the figure-8 configuration can reduce some types of noise. Use the laptop interface to select either configuration.

Noise phase. The noise phase is a 1.7ms window, during which the detector samples environmental noise and updates a "rolling noise average" used to determine the tag detection threshold.

A separate rolling noise average is maintained for each of the three ac line phases: 0°, 120°, and 240°. To do this, first a transmit phase is associated with the 0° line phase. The next time this phase occurs, a noise phase is associated with it, and so on. This alternation is also true for the other two line phases: 120° and 240°.

0° (T) phase 1,
120° (N) phase 2,
240° (T) phase 3,
0° (N) phase 4,
120° (T) phase 5,
240° (N) phase 6,
0° (T) phase 7, and so on.

This way, if one ac line phase is quiet and the other two are noisy, then the detector can concentrate tag detection to the quietest line phase.

Note: In previous Ultra•Max detectors, the tag detection threshold was always 12dB (or four times) above the average noise level at any point in time (Figure 3). This was fine when the noise average was low, but if the noise average increased, multiplication effects caused the tag detection threshold to become so high, it decreased the EAS detector's sensitivity by allowing it to detect only the highest in-band signal levels.

In this detector, the degree of unpredictability of noise samples is a significant factor for determining the tag detection threshold. This allows the detector to develop a tag detection threshold that is always "just enough" above the noise average, providing a great improvement in detector sensitivity.

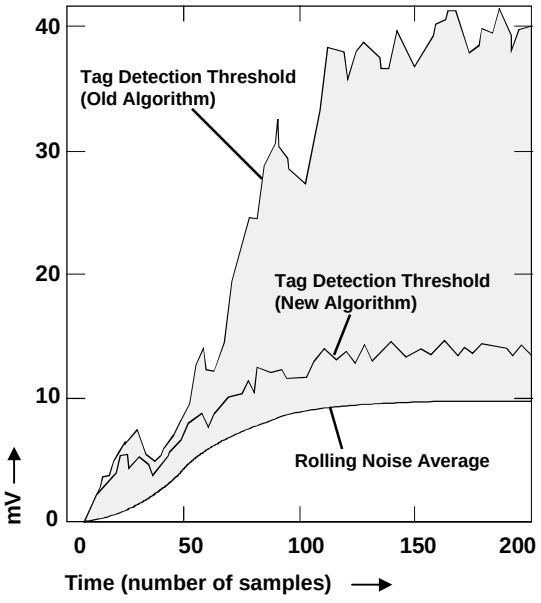
Sequencing Parameters

Associated with each mode of operation are six sequencing parameters. These are:

- **Transmit enable.** Defines whether or not the phase is a transmit phase or a noise phase.
- **Transmit select.** Determines whether the primary or secondary pedestal is transmitting.
- **Transmit configuration.** Determines the type of transmit antenna phasing used (aiding or figure-8).
- **Transmit frequency.** Determines the transmit frequency (57.8kHz or 58.2kHz).
- **Primary receive.** Connects the primary antenna to the receiver. When inactive, this parameter disconnects the primary antenna from the receiver.
- **Secondary receive.** Connects the secondary antenna to the receiver. When inactive, this parameter disconnects the secondary antenna from the receiver.

Note: The receiver momentarily disconnects from the primary and secondary antennas during the power up self test and diagnostic tests.

Figure 3. Tag detection threshold: Previous Ultra•Max detectors vs. Ultra•Post



Detection Routine (tag detected)

A signal that meets tag criteria causes the detector to lock on the transmit frequency and coil phasing in effect when the signal was detected. This way, the detector can run tests on subsequent signals to determine whether they are from a tag or noise source.

The first receive window that receives an in-band signal above the tag detection threshold, initiates a series of checks called a “validation sequence” (Figure 4).

During this sequence, the detector:

- Locks onto the transmit antenna configuration in effect when the signal was first detected
- Locks the operating frequency present at detection (57.8kHz or 58.2kHz)
- Increases the transmit burst repetition rate to 90Hz (60Hz ac) or 75Hz (50Hz ac)
- Checks subsequent phases for characteristic tag behavior.

Validation checks are as follows:

Hit (H). A hit must occur the number of times entered into configurator software before an alarm can be initiated. A hit occurs only if the in-band signal:

1. Falls within a receive window
2. Exceeds the tag detection threshold calculated by the detector for the current phase.

Note: The ac line phase where the first hit occurred is called the “hit phase”. Certain checks performed during the validation sequence must occur during this phase. If hit criteria are met during a non hit phase, the hit will be counted; but if these criteria are not met, the validation sequence will not abort.

Forced transmit off check (FT). This check occurs during the hit phase and is used to prevent undesired alarms caused by interference with other detectors and undesired alarms due to noise. During this check, the transmitter turns off when the transmitter would normally be on. Since a tag signal would not exist when the transmitter is off, the reading at the detector’s A/D converter has to be at least 6dB less than the tag detection threshold to pass this check.

Natural Tx Off (NT). This check performs a noise check during the hit phase and is mainly used to prevent undesired alarms due to noise. The reading at the detector’s A/D converter has to be less than the tag detection threshold to pass this check.

Figure 4. Validation sequence

Line Cycles	0			1			2			3			4			5			6			7			8			9
Phase	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A
Phase Type	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N	T	N
Hits Req'd:																												
3 Hits	H	-	H	NT	-	-	FTFC	-	HA																			
4 Hits	H	-	H	NT	H	-	FTFC	-	HA																			
5 Hits	H	-	H	NT	H	-	H	-	-	NT	-	-	FTFC	-	HA													
6 Hits	H	-	H	NT	H	-	FT	-	H	NT	H	-	FTFC	-	HA													
7 Hits	H	-	H	NT	H	-	FT	-	H	NT	H	-	H	-	-	NT	-	-	FTFC	-	HA							
8 Hits	H	-	H	NT	H	-	FT	-	H	NT	H	-	H	-	H	NT	-	-	FTFC	-	HA							
9 Hits	H	-	H	NT	H	-	FT	-	H	NT	H	-	H	-	H	NT	H	-	FTFC	-	HA							
10 Hits	H	-	H	NT	H	-	FT	-	H	NT	H	-	H	-	H	NT	H	-	H	-	-	NT	-	-	FTFC	-	HA	

H = Hit
NT = Natural Tx Off
FT = Forced Tx Off
HA = Hit and Alarm
FTFC = Forced Tx Off and Freq. Checks
"-" = N/A or "don't care"

Forced transmit off and frequency check (FTFC). This check always occurs during the next-to-last hit phase of a successful validation sequence. During this phase, the forced transmit off check is applied as before, but in addition, the frequency samples measured in the preceding receive phases are compared to the valid tag cutoff frequency selected using configurator software. If any of the samples exceed the valid tag cutoff frequency, or the difference between the highest and lowest sample frequency exceeds the "delta frequency" value selected using configurator software, then the detector assumes that the response is from a partially-deactivated tag or noise and the validation aborts.

Hit and alarm (HA). If the last hit of a selected number of hits occurs, then the detector initiates an alarm. If not, then the validation sequence aborts and the detector returns to looking for tag signals (no alarm). This hit can occur in a hit phase or non hit phase.

Note: The validation sequences presented in Figure 4 are for ideal low noise conditions. Keep in mind that if a hit that occurs in a "non hit phase" is not processed due to noise, the duration of the sequence extends beyond what is shown in the figure to include hit phases where a hit is processed (up to the selected number of hits). But if a hit is not processed in a hit phase (except for the Forced Tx Off Phase), the sequence aborts.

Detailed Circuit Theory

Note: The detector can be set for 58kHz or 60kHz operation. 58kHz operation is described in this manual.

LPA Transmitter Board

(for use in Europe)

The LPA transmitter consists of the following components (Figure 5).

EMI filter (1). Reduces circuit induced electrical noise to the 90–264Vrms line input. Its output is also 90–264Vrms.

Rectifier and storage capacitors (2). The rectifier converts the ac source voltage to high-voltage dc. Jumper JW11 adapts the unit to the ac source (120Vac or 240Vac). This jumper is out for 240Vac. The storage capacitors provide a nominal 320Vdc (HVDC) to the logic supply and to the main power supply used to drive the transmit antenna.

Zero-crossing detector (3). Outputs a negative pulse (0-XING) at every positive-going zero crossing of its ac input. The leading edge of this pulse enables the detector to time its functions to the ac line.

Opto-isolator (4). Transfers the high voltage output of the zero crossing detector to the logic circuitry.

Logic supply flyback converter (5). Supplies regulated +5Vdc to run logic on the receiver/controller board. It also supplies 14V to 17V to the +12V regulator, –14V to –17V to the –12V regulator, and 14V–17V (VAUX) to a PWM controller.

+12V linear regulator (6). Converts the +14V to +17V output off a flyback transformer to regulated +12Vdc, used to power analog circuitry and pedestal's cooling fan.

–12V linear regulator (7). Converts the –14V to –17V output off a flyback transformer to a regulated –12Vdc, used to power analog circuitry.

PWM controller (8). Regulates the logic supply's 5V output using a feedback signal and pulse width modulation (PWM). If the output of the +5Vdc supply decreases, then this chip increases the duty cycle of the PWM to increase the voltage back to +5Vdc. If the output of the +5Vdc supply increases, then this chip decreases the duty cycle of the PWM to decrease the voltage back to +5Vdc. A 125kHz signal (OSC) sets the switching frequency.

Startup circuit (9). The PWM controller is started by a capacitor that is charged off of the rectified ac input voltage. The PWM controller requires a startup voltage of 16V to run until voltage drops below 10V.

Opto-isolator (10). Transfers the low voltage feedback signal from the +5Vdc supply back to the high voltage side of the PWM controller.

Main power supply (11). Supplies regulated ±47Vdc and 73V (BIAS_V) used to run the linear amplifiers which supply current to the antenna coil when the antenna is transmitting. To regulate the output voltage, a 125kHz signal (OSC) is gated on or off to the gate drive circuit.

Circuit noise generated by this power supply tends to interfere with reception during receive windows. Thus a charge inhibit (CHG_INHBT) signal from the receiver/controller board is used to turn off this supply during these windows, thus interrupting normal regulation.

125kHz oscillator (12). Generates the 125kHz switching frequency used to synchronize the main and logic supplies.

Opto-isolator (13). Transfers the low voltage CHG_ INHBT signal from the receiver/controller board to the high voltage section of the voltage main power supply.

Gate drive circuit (14). This circuit turns the main supply off when its +47Vdc output exceeds +48Vdc, and turns the main supply on when its output drops below +46.5Vdc except when overridden by the CHG_ INHBT signal.

Transmit Phase Select (15–19)

To switch between aiding or figure-8 antenna configurations, the receiver/controller board sends a BURST signal to two op amp circuits that generate equally amplified but 180° out-of-phase signals. The top coil power amplifier always receives the same signal as an input, while the bottom coil power has its input electronically switched between in-phase and out-of-phase signals by signal TX_CFG from the receiver/ controller board.

Figure 5. LPA transmitter board 0301-0784-01

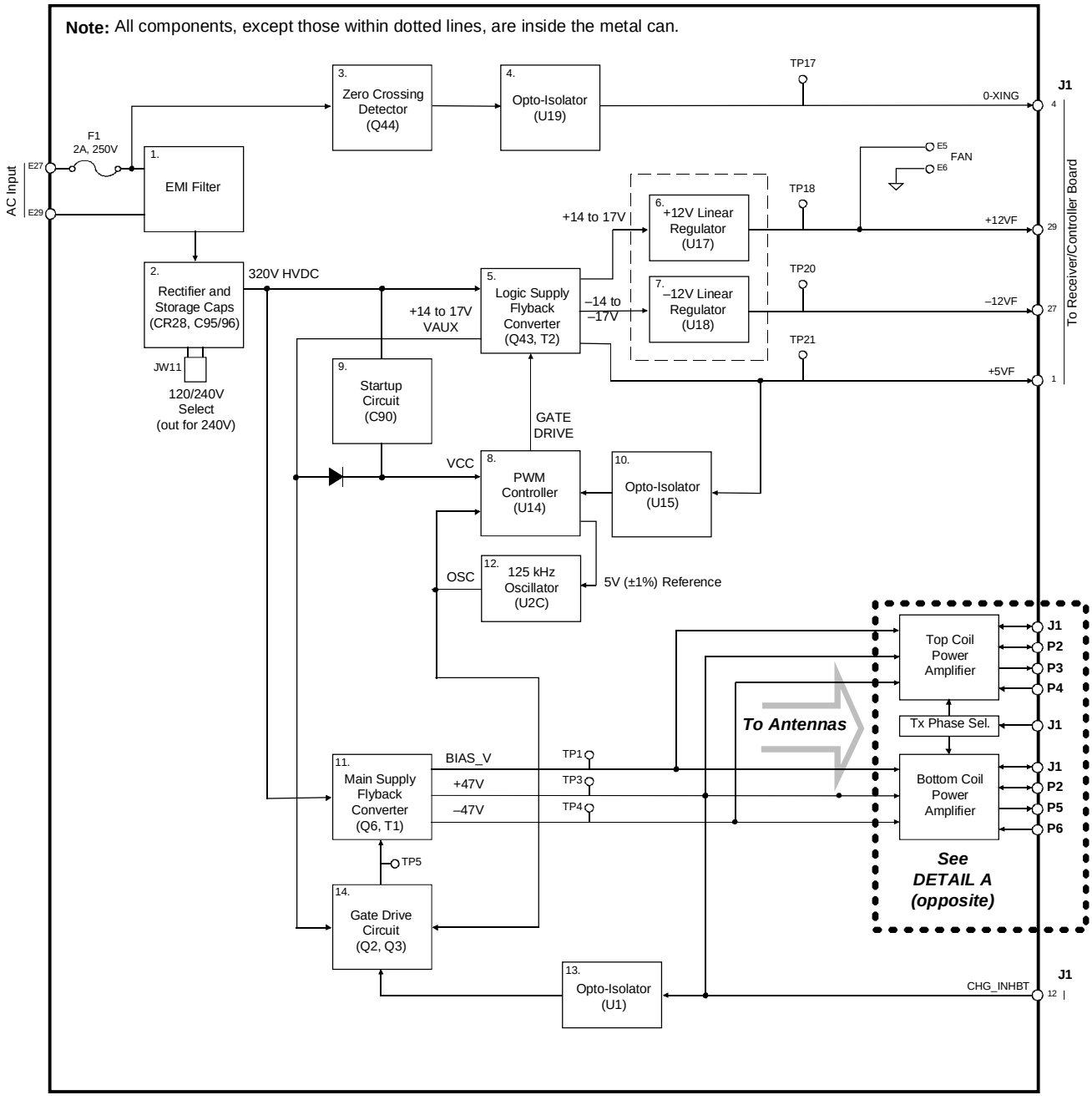
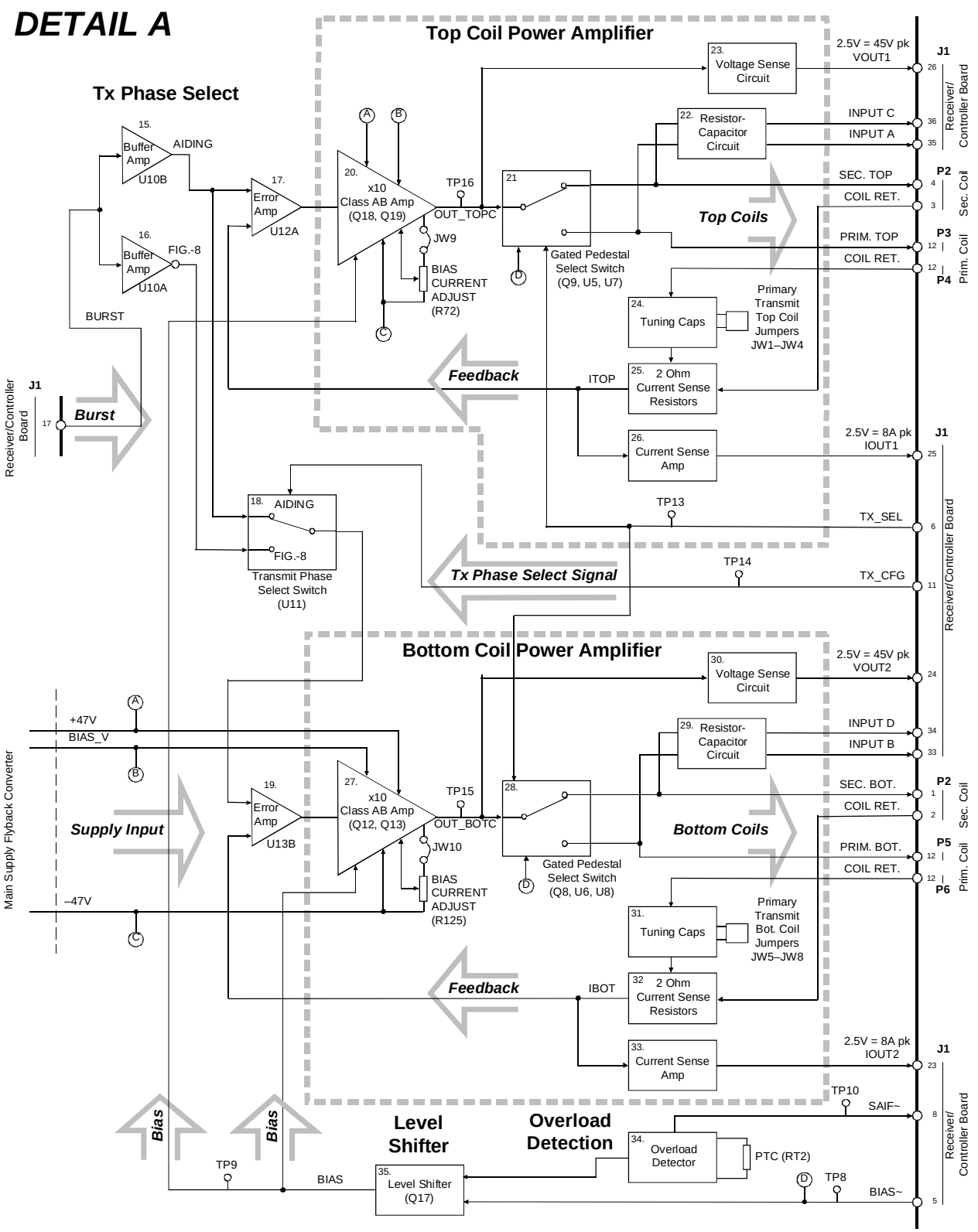


Figure 5. (continued)



Top/Bottom Linear Power Amplifiers (20–33)

These identical Class AB amplifier channels are each capable of driving 8A peak into a high Q antenna. A BIAS~ (bias not) signal from the receiver/controller board enables these amplifiers. Current feedback keeps the output current following the input signal despite the inductive load.

x10 Class AB amplifier (21, 27). Amplifies its input 10 times. Hardwired jumper JW9/JW10 enables you to monitor bias current with a current probe. Potentiometer R72/R125 is used to adjust the bias current.

Gated pedestal select switch (21, 28). A TX_SEL signal from the receiver/controller board enables triac switching circuits to select whether amplifier outputs are connected to the primary or secondary pedestal antenna coils. The BIAS~ signal from the receiver/controller board makes these connections only during transmission.

Resistor-capacitor circuit (22, 29). Decouples the antenna coils from the receiver inputs.

Voltage sense circuit (23, 30). Sends burst envelope information to the receiver/controller board. Reduces the output of the x10 amplifier to a voltage compatible with the input of the microcontroller on the receiver/ controller board.

Tuning capacitors (24, 31). Tuning capacitors for resonating with the coils when in the transmit mode are on the board. Jumpers JW1–JW4 adjust capacitance for the top coil; jumpers JW5–JW8 adjust capacitance for the bottom coil. The secondary pedestal has its own set of tuning capacitors.

2-ohm current sense resistors (25, 32). Provide a reference feedback voltage used to regulate the input to the x10 amplifier.

Current sense amplifier (26, 33). Sends current amplitude information to the receiver/controller board. About 2.5V indicates 8A.

Overload detector (34). A comparator monitors a PTC thermistor mounted on the same heat sink as Q18 and Q19 of the top coil power amplifier. If the temperature exceeds approximately 105°C, then this circuit disables the transmitter by sending a signal (SAIF~) to the receiver/controller board to override the BIAS~ signal and stop current flow until the overload condition is corrected.

Level shift circuit (35). Converts the BIAS~ signal to a level suitable to bias the x10 amplifiers.

Switched-Mode Transmitter

Switched-Mode Transmitter

Used primarily for non-European applications, the switched-mode transmitter board 0301-0791-01 generates operating voltage for the receiver/controller and audio/visual alarm boards. It also supplies current to the antennas through a high current switching transmitter.

Controlled by the receiver/controller board, this board simultaneously drives one pair of coils and multiplexes two pairs of coils; one pair in the primary pedestal, the second pair in the secondary pedestal. Also the top and bottom coils can be configured in figure-8 or aiding. The following items refer to Figure 6:

EMI filter (1). This filter accepts worldwide input voltages from 90-264Vrms @ 50/60Hz. The filter meets FCC Class B requirements.

Rectifier and storage capacitors (2). Bridge rectifier/ bulk capacitors accept two ranges of line voltage inputs (90–132Vrms or 180–264Vrms) and provide high capacity 160Vdc and 325Vdc unregulated outputs. The line input range is set for 120V by installing JW1 (in) and setting JW2, 1-2; 240V is selected by removing JW1 and setting JW2, 2-3.

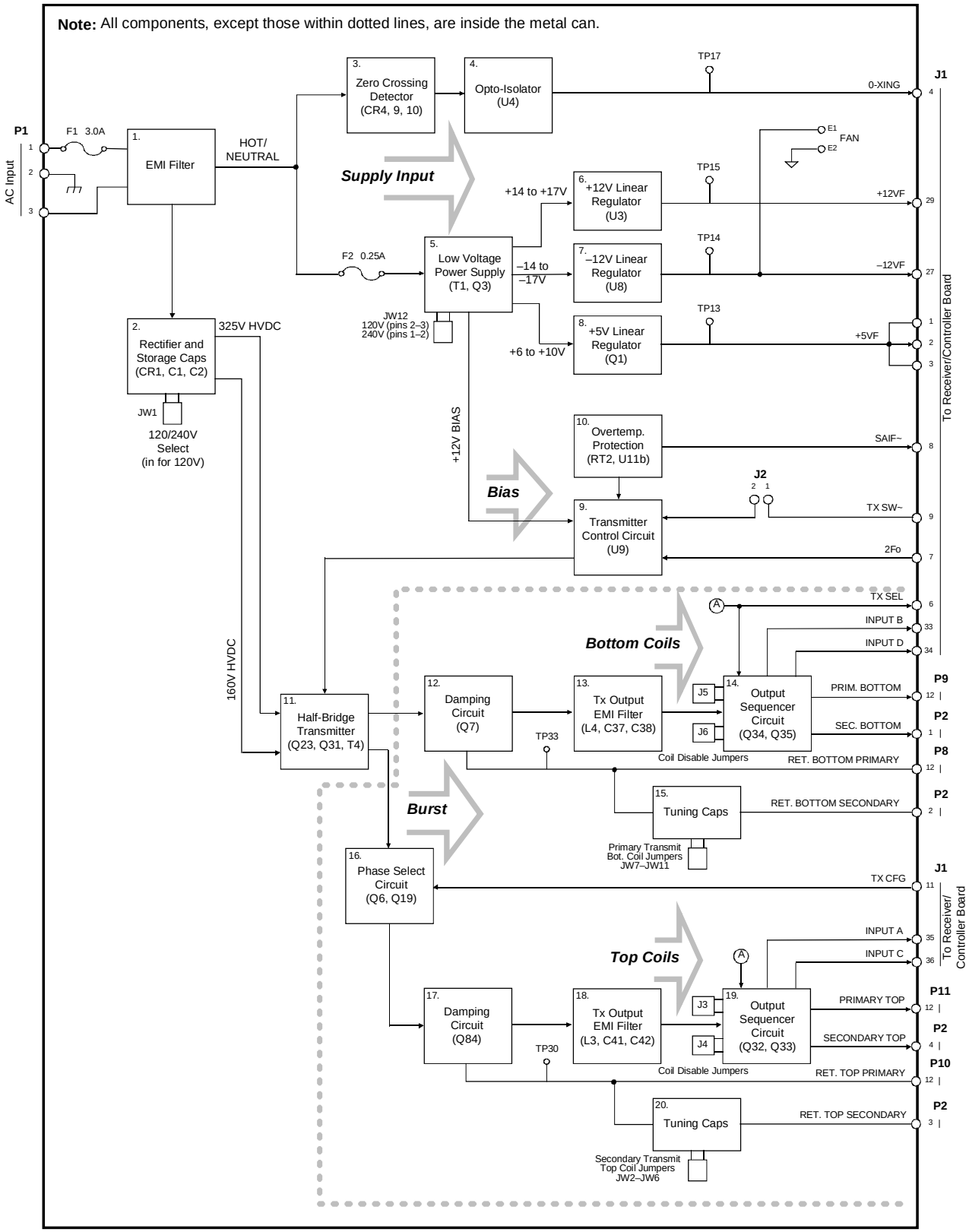
Zero crossing detector (3). The zero crossing circuit uses the filtered ac line input to generate an isolated negative edge trigger (TTL compatible) signal when the line input crosses 0V (positive slope). The receiver/ controller board uses this edge as the clock to generate detector timing such as transmit and receive windows.

Opto-isolator (4). Transfers the high-voltage output of the zero-crossing detector to the logic circuitry.

Low voltage power supply (5). This supply accepts two ranges of line voltage input (90–132Vrms and 180–264Vrms) and provides isolated +5V, +12V, and -12V outputs to the receiver/controller board and also to control circuits in the transmitter and alarm boards. The input line voltage range is selected by installing JW12 across pins 2 and 3 (120V) or across pins 1 and 2 (240V). This jumper is located close to JW1 which also needs to be changed for the proper ac voltage.

+12V linear regulator (6). Converts the +14V to +17V output out of the low voltage power supply to regulated +12Vdc, used to power analog circuitry.

Figure 6. Switched-mode transmitter board 0301-0791-01



–12V linear regulator (7). Converts the –14V to –17V output out of the low voltage power supply to a regulated –12Vdc, used to power analog circuitry and the pedestal's cooling fan.

+5V linear regulator (8). Converts the +6V to +10V output out of the low voltage power supply to a regulated +5Vdc, used to power logic circuitry.

Transmitter control circuit (9). Control signals from the receiver/ controller board are used as follows:

1. Twice the transmit frequency, the 2Fo signal synchronizes the transmitter control pulse width modulator (PWM) to switch at the desired transmit frequency (the PWM divides the frequency by two).
2. The TX_SW~ control signal enables and disables the transmitter control PWM to generate the 1.6ms transmit bursts. The transmitter control PWM is coupled to the half-bridge power converter via a gate drive transformer circuit. This gate drive circuit isolates the drive signals and allows the PWM control circuit (referenced to ground) to provide the proper gate drive signals to the two power MOSFETs (referenced to the 325Vdc and the primary return). The half-bridge transmitter provides three outputs; one of these outputs is 180° out-of-phase to the other two.

Over temperature protection circuit (10). The phase select circuit uses a thermistor (RT2) on the heatsink with the power triacs to shut the transmitter off and to generate the set amplifier interrupt flag (SAIF-~) signal to the receiver/controller board during excessive temperature operation. The thermal device will typically trip at 90 to 100°C.

Half-Bridge Transmitter (11). This circuit uses 325 Vdc bus and control signals from the receiver/ controller board (0301-0785-01) to generate bipolar (±) voltage outputs needed to drive the coils during transmission. This circuit has three outputs, one of which is out-of-phase with the other two. One of the outputs is used to drive the antennas on every burst. The other two are inputs to a phase select circuit.

Damping circuit (12, 17). The ring-down circuits use the same control signal (TX_SW~) as the transmitter control PWM to turn on power MOSFETs during the transmit burst (provide a low impedance) and turn off the power MOSFETs at the end of the transmit burst (provide a high impedance). This circuit is needed because one common power circuit drives two pedestals and the transformer provides tight coupling between the two outputs (therefore a low impedance). This results in the ring down of the transmitter current being excessively long without the ring-down circuits.

TX output EMI filter (13, 18). Duplicated for each transmitter output, this circuit is a combination of differential and common mode filters. To comply with agency regulations, these filters control transmitter voltage slew rates and dampen voltage ringing that causes excessive E and B field emissions.

Output Sequencer Circuits (14, 19). These circuits steer the filtered transmitter outputs to the proper coils during transmission. Each output has two sequencer circuits which direct the transmitter output to one of two possible pedestals (Tx Top are common and Tx Bottom are common to each transmitter output). The TX_SEL control signal from the receiver/controller board controls sequencer circuits individually. An output of the half bridge control PWM (2FTX, not shown) is buffered and is used to ultimately provide an ac drive signal to the power triacs. The TX_SEL signal is AND'ed with the transmitter enable signal (TX, not shown) to generate enable signals to the appropriate primary and secondary antennas. Each sequencer circuit AND's the PWM output signal and the enable signals (1.6ms pulse) to drive the power triacs. The triacs are isolated from the low voltage circuits via gate drive transformers T7 & T8.

Tuning capacitors (15, 20). Tuning capacitors for resonating with the coils when in the transmit mode are on the board. Jumpers JW2–JW6 adjust capacitance for the top coil; jumpers JW7–JW11 adjust capacitance for the bottom coil. The secondary pedestal has its own set of tuning capacitors.

Phase select circuit (16). During transmission, the antenna coils can be driven in an aiding or Figure-8 configuration. This is achieved by selecting outputs of the half bridge transmitter (one which is 180° out-of-phase with the other).

Receiver/Controller Board

Receiver/controller board 0301-0785-01 consists of a receiver section and a controller section (Figure 7).

Receiver Section

The receiver contains the following components:

Input steering (1). These switches serve a dual purpose: they control which receiver coil (primary

or secondary) is active, and when the switches are open, they reduce the transmit voltage applied to the receiver gain stages.

Low noise preamplifiers (2). These devices amplify signals from the antenna coils by 16–20dB, depending on the condition of the phase control switch.

Coil phase control (3). Allows the microprocessor (µP) to electronically control the phase relationship of signals arriving from the top and bottom antenna coils.

When TP31 is high, the receiver is in a Figure-8 condition. In this condition, coil phase control circuitry acts as non-inverting amplifiers with a gain of 10x (20 dB) with essentially no phase difference between the amplifiers.

Note: Since the top and bottom receiver coils are wired 180° out-of-phase, the signals at the preamplifiers' outputs are 180° out-of-phase. The coil wiring produces the phase reversal, not the circuitry.

When TP31 is low, the receiver is in a "quadrature" condition. Circuit values provide a 90° phase difference between the outputs of coil phase control circuitry. A phase-switched preamplifier allows the receiver antennas to operate in either figure-8 mode for noise cancellation, or quadrature (90°) mode which combines the two antenna outputs such that there are no null areas or "holes" in the receiver field.

Summing amplifier (4). This device combines signals from the top and bottom receiver coils and amplifies them 20x (26dB). Balance adjustment R59 allows control of the relative proportion contributed by each coil. With the receivers in figure-8 mode, the signals at the outputs of the two phase control amplifiers are 180° apart and signals reaching both antennas about equally can be electrically nulled using R59. With the receivers in quadrature mode, the signals at the outputs of the two phase control amplifiers are 90° apart. While interference sources can not be nulled in this mode, R59 can be used to reduce the contribution (hence noise) from whichever coil is closer to the noise source. Since the signal level from one coil is reduced in this technique the detector sensitivity near that coil will also be reduced. The default position for R59 is mid-rotation.

59.0kHz bandpass amplifier (5). A synchronously-tuned filter, each stage of this amplifier provides approximately 4.2dB of gain at 59.0 kHz. Thus the overall gain of the amplifier is 16.8dB (6.9x). The overall bandwidth of this stage is 5kHz, and its center frequency is 59kHz.

Sampling mixer (6). This is an electronic switch, controlled by a 5V logic level signal. It is called a sampling mixer because its output consists of a series of time domain pieces or samples of the input signal. These samples contain the traditional sum (input + LO) and difference (input – LO) frequency components present at a mixer output.

IF amplifier (7). This is a fixed-tuned 8th order bandpass amplifier with a center frequency of 10.235 kHz and a bandwidth of 1.0kHz. The stages of this amplifier/filter have the same topology as the bandpass amplifier described above.

This amplifier takes sum and difference frequency components from the mixer and heavily attenuates the sum (126.235kHz) while amplifying the difference (10.235kHz) by 25.8dB.

This amplifier's output is split and sent to two different circuits: the sinusoidal output is sent to a diode limiter and comparator, and to a full-wave rectifier.

A broad band gain controlled amplifier is imbedded within the IF amplifier.

- With both control gates high, the stage provides 20dB of gain.
- When control line GAIN_1 is low, gain is 10dB.
- When control line GAIN_2 is low, the gain is 0 dB.

This gain cutting capability prevents very high noise environments from causing the late gain stages to clip, preventing accurate signals from being measured.

Buffer amplifier (8). This unity gain non-inverting buffer provides a convenient point for adding gain or attenuation should it prove necessary in the future.

Squaring circuit (9). Consists of three parts:

- Diode limiter, which clips the output of the IF amplifier to a maximum of about 1.4Vp-p;
- Level shifter, which moves this square wave to a point centered at 2.5V; and
- Inverting comparator, which converts the input waveform into a 0-5V square wave.

The output of the squaring circuit is sent to the microcontroller, where the period between the rising and falling edges is accurately measured. The microcontroller actually determines the frequency of the output of the IF amplifier. If this frequency is subtracted from the LO, the equivalent receiver input or tag frequency can be determined.

Full-wave rectifier (10). Since the A/D converter within the microcontroller only accepts positive voltages, the output of the IF amplifier's buffer amplifier, which is centered at ground, must be rectified to eliminate the negative voltages. This is an active, full wave rectifier which functions as an ideal diode (no diode voltage drop). This circuit is broad band and has unity gain.

3-kHz low-pass filter (11). Since the output of the full wave rectifier is a series of positive half cycles of a sinusoidal waveform, the major frequency component of the waveform is centered at 20.470kHz, with a dc offset. This filter integrates the energy in this "pulse train" and effectively smoothes the output into a slowly changing dc waveform which follows the envelope of the IF output. In so doing, it functions as the receiver's second detector, converting the IF output down to dc. The gain of the filter is 6dB.

Buffer amplifier (12). This unity-gain, non-inverting buffer isolates the passive second stage of the low pass filter from the resistive divider which serves as the input to the A/D converter. There are three taps from the voltage divider, which provide direct, ½ value and ¼ value samples of the detected signal to the A/D converter contained within the microcontroller.

Signal inverter (13). This chip inverts the REC signal from the microprocessor to a REC~ signal for use in the receiver.

Calibration circuit (14). Taking its input from the summing amplifier output of the DAC, this circuit allows the microcontroller to supply a very precise 100mV peak sine wave to the input of the receiver. By knowing the input level and measuring the output level, the microprocessor can then accurately measure the overall gain of the receiver. Also, knowing this gain and the average noise level at the A/D input for any phase, the equivalent input noise can be determined. Combining this with the current tag detection threshold, the ongoing sensitivity of the receiver can be determined.

Figure 7. Receiver/Controller board 0301-0785-01

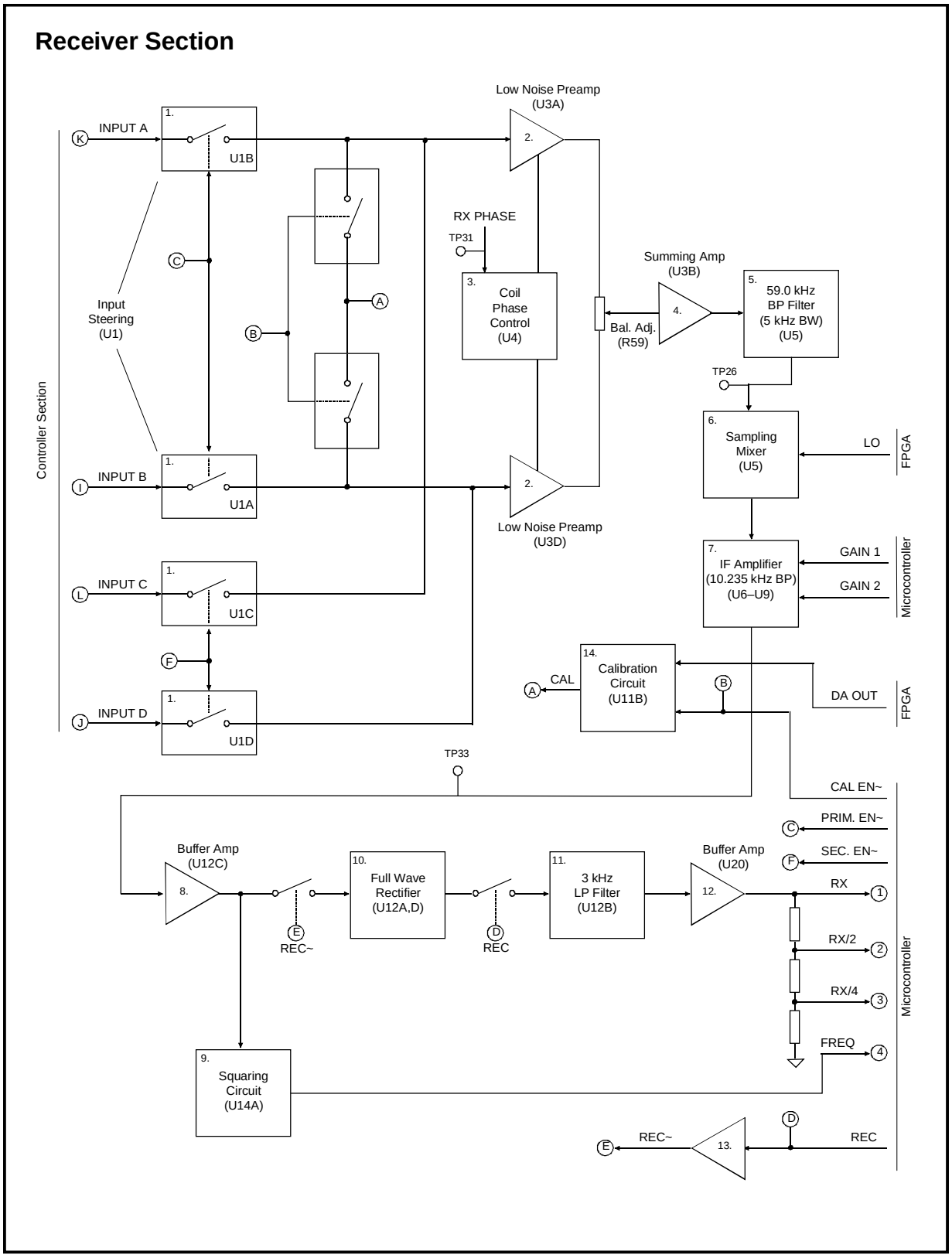
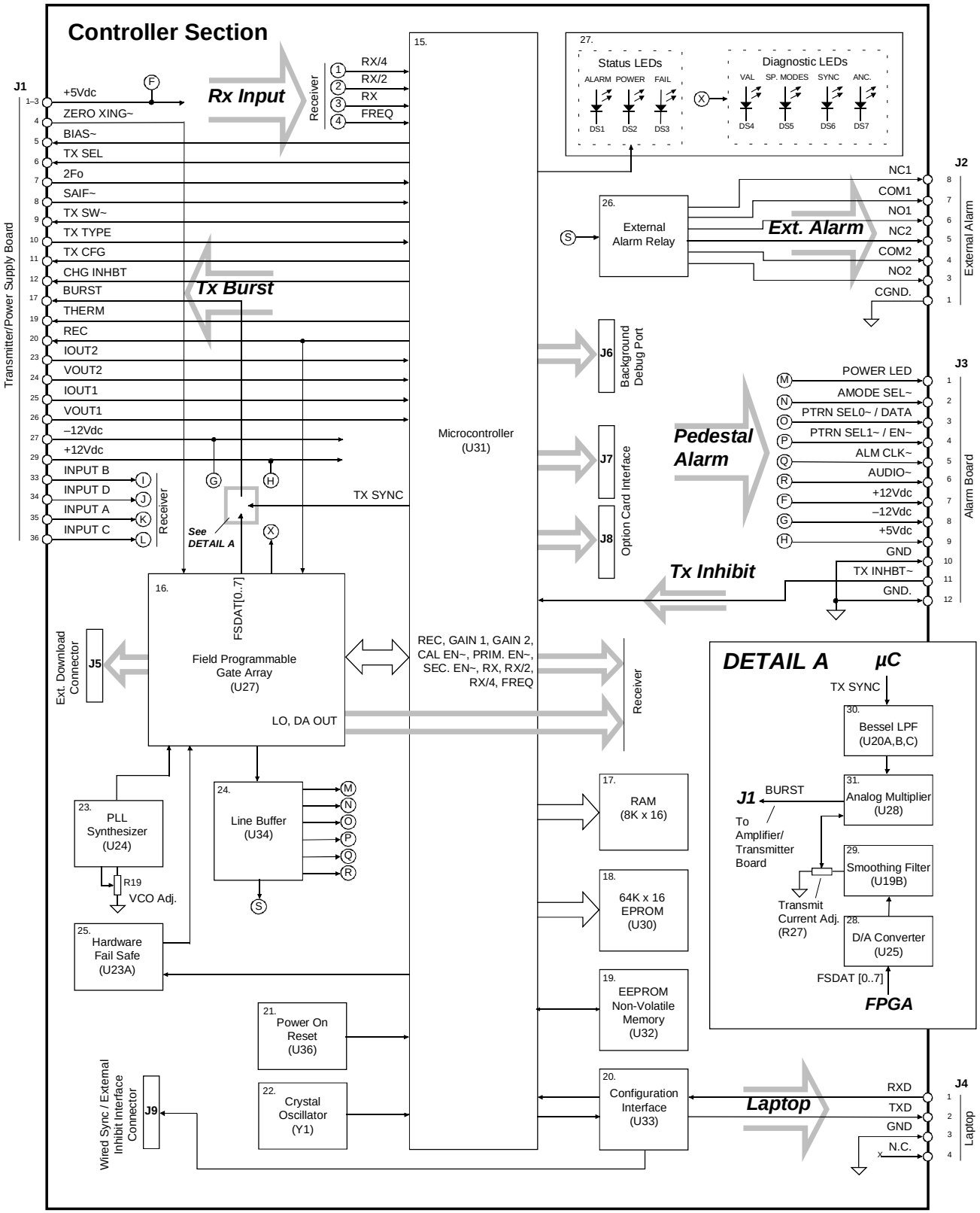


Figure 7. (continued)



Controller Section

Microcontroller (15). This 16-bit microcontroller functions in tandem with the field programmable gate array (FPGA) circuit as the controller for the detector.

Field programmable gate array (16). This programmable logic chip consolidates several miscellaneous circuit functions, such as the programmable counter for the PLL synthesizer, counters and timers used in tag frequency measurement, line sync delay timers, diagnostic LED drivers, and some alarm timing. It also contains a state machine for 58kHz sine wave generation. Alarm timing signals for the audio/visual alarm are generated by the FPGA and sent to the alarm board.

8K x 16 RAM (17). Provides temporary variable storage for microcontroller operation such as tag and noise measurements, and detection parameters. Added memory can be plugged in via connectors J7 and J8 on the board (for diagnostics only).

64K x 16 EPROM (18). This flash EPROM contains the detector's operating instructions and default parameters.

EEPROM (19). 128 bytes of Non-Volatile Memory (NVM) stores user-selectable parameters.

Laptop configuration interface (20). This interface enables a laptop computer to communicate with the microcontroller for setup or diagnostic purposes. An RS-232 receiver/driver connects to the processor's serial port (J4).

Power-on reset (21). Ensures reliable starting of the microcontroller and has an internal watchdog routine which prevents software "hang ups".

Crystal oscillator (22). This 16.384MHz clock serves as the instruction clock (which controls all detector timing).

PLL synthesizer (23). This circuit is a computer controlled phase lock loop that produces all the detector-related (58kHz and LO) signals. This synthesizer allows the microcontroller to generate any frequency from 51.4kHz to 102.4kHz in 200Hz steps.

The LO is a 5V clock signal, which is always 10.235 kHz above the desired receiver frequency. Because of this relationship, a 58kHz tag signal at the output of the bandpass amplifier is "sampled" by the mixer (see item 23). Its output contains sum (58kHz + 68.235kHz) and difference (58kHz – 68.235kHz) frequency components. If frequency hopping mode is enabled, LO also hops to maintain a constant 10.235kHz difference with respect to the desired receiver operating frequency.

Line buffer (24). Enables signals from the FPGA to reach the alarm board without interference.

Hardware fail safe circuit (25). This circuit prevents catastrophic damage to the transmitter's power amplifier by changing state if the TX_SYNC (and hence the transmitter burst) should ever exceed 2.38ms. This state change forces the logic of the FPGA to stop transmission and informs the microcontroller of the error condition.

External alarm relay (26). The relay provides two Form C, DPDT dry relay contacts for activating external alarms, counters, or other external equipment.

LED indicators (27). LED indicators across the top edge of the board indicate status functions which may be useful for diagnostic purposes. During the power-on self-test, all the LEDs flash simultaneously to test their function, then they light in sequence to indicate the progress of the power on self-test.

- Red ALARM LED (DS1) indicates an alarm condition when the alarm board is not connected or when the visual alarm has been disabled.
- Green PWR LED (DS2) indicates that the board is powered and that the processor is running.
- Red ERROR LED (DS3), located near the relay, flashes in a coded sequence whenever the board fails the power-on self test, or run-time diagnostic tests, or when a serious failure interrupt occurs.
- Yellow VAL LED (DS4) is on during a tag validation sequence.
- Yellow SPCL MODES LED (DS5) indicates that the detector is operating with special modes active, usually used during detector diagnostic tests. Most special modes automatically time out after 17 minutes.
- Green SYNC LED (DS6) indicates that the detector has detected another Ultra•Post detector in the area and has successfully synchronized with it (only when synch is hardwired). (Wireless synch does not use DS6.)
- Yellow LED (DS7) represents different conditions depending on any special modes in effect. Currently used to determine if the detector failed the tag frequency test.

D/A converter (28). Based on code contained within the FPGA, 8-bit digital signals supplied to the data input of this chip produce 40 different voltage levels which form a “stairstep” sinusoid at the detector’s operating frequency.

Smoothing filter (29). In combination with the differential amplifier at the output of the D/A converter, this low pass filter smoothes the stairstep output of the D/A converter into a very low distortion sine wave whose level is set by R27 (transmitter current adjustment). This low distortion sine wave serves as one of the inputs to an analog multiplier (item 17).

Bessel low pass filter (30). The FPGA produces a 5V, 1.6ms logic pulse whenever the power amplifier is expected to produce a transmitter burst. This logic pulse is sent to a 3rd order Bessel low pass filter, which slows down the square wave’s fast edges and produces a pulse with smoother rise and fall times. The Bessel filter’s output connects to the multiplier’s other input.

Analog multiplier (31). Creates a sine wave burst at the detector frequency, whose envelope has the “soft” rise and fall times required by the amplifier. Two series-connected output gating switches following the analog multiplier open during receiver windows to ensure no low-level 58kHz sine wave energy can pass to the power amplifier and hence, possibly couple to the antenna coils.

I/O connectors. These consist of the following:

- Primary card-edge connector (J1), which provides power supply connections, receiver inputs, transmitter inputs, transmitter voltage and current information, as well as logical control lines.
- External alarm terminal block (J2), which provides two Form C DPDT dry relay contacts for activating external alarms, counters, or other external equipment.
- Alarm board connector (J3), which provides power supply and control signals to the detector’s alarm circuitry located under the pedestal’s top cover.
- Configuration interface (J4), which provides the link to a laptop computer for detector programming, as well as external inhibit control.
- FPGA external download connector (J5), which provides a means for factory to download debug code to reach the FPGA.
- Background debug port (J6) provides a link for production to interface a hardware debugger to the microcontroller.
- Option port connectors (J7, J8), which allow future features to be added through optional daughter cards.
- Wired sync/external inhibit connector (J9), which allows a secondary switch to temporarily disable the transmitter and alarm functions.

LPA Transmitter Cap Tuner Board (Secondary)

In the secondary pedestal, cap board 0301-0812-01 contains jumpers JW1–JW8. These jumpers are configured in various combinations to set the capacitance of the antenna’s RLC circuits for the maximum transmit current. This compensates for small variations in the inductance of the transmit coil and for environmental factors.

Switched Mode Transmitter Cap Tuner Board (Secondary)

In the secondary pedestal, cap board 0301-0816-01 contains jumpers JW2–JW6 used for the top coil, jumpers JW7–JW11 used for the bottom coil. These jumpers are configured in various combinations to set the capacitance of the antenna’s RLC circuits for the maximum transmit current. This compensates for small variations in the inductance of the transmit coil and for environmental factors.

Alarm Board

Alarm board 0301-0810-01 consists of the following components (Figure 8):

Visual Control (1–6)

Visual control consists of the following six circuits:

Protection circuit (1). Protects the LEDs from damage should a hardware failure cause them to be on continuously.

PLD circuit (2). Contains coded instructions for generating the three LED alarm indication patterns.

Flash mode (3). Provides the logic to drive all LEDs simultaneously.

Shift register (4). Not used.

LED driver (5). Provides enough current to drive the high-brightness LEDs.

Alarm LEDs (6). A ring of 14 high-intensity LEDs indicate that a tag was detected by displaying one of three distinct patterns.

- Race track: During this pattern, the ring of LEDs flash in a rotating clockwise motion. Clock frequency is approximately 15Hz.
- Star burst: During this pattern, opposing LEDs flash from the center of the board to the outside of the board and back again. Clock frequency is approximately 15Hz.
- Flash: During this pattern, all LEDs flash at the same time. Clock frequency is approximately 3Hz.

Audio Control (7–11)

Audio control consists of the following five circuits:

12V sense and storage caps (7). The sense circuit indicates the loss of the 12V supply. Should the 12V supply drop, the storage caps will power alarm circuitry for approximately one minute.

Oscillator (8). Provides an audio frequency around 2.6kHz.

H-driver and volume control (9). Two operational amplifiers (U2a and U1b) are used as a bridge amplifier (H-driver) to sound the buzzers. Volume level is adjusted using potentiometer R8, accessible from the top or bottom of the board.

Buzzers (10). Buzzers LS1 and LS2 provide an audible indication that a tag was detected.

"Dying gasp" enable (11). When enabled, every time that power is removed from the detector, an audio indication indicates that a power failure occurred. To disable this feature, remove jumper JW1 on the solder side of the board.

Transmit Inhibit Circuit (12)

This circuit enables you to disable the transmitter for diagnostic purposes, such as determining whether the unexplained alarms are caused by interference (if the alarm continues) or by tags placed too close to the detector (if the alarm stops). This circuit works as follows:

Using a straightened paper clip or other suitable device, press pushbutton S1, located within the LED ring.

1. Press S1 once to disable the detector transmitter for 30 seconds (power LED at the center of the board remains on continuously).
2. Press S1 a second time to disable both the transmitter and alarm circuitry indefinitely (power LED flashing rapidly). This prevents annoying continuous alarms until the detector can be serviced.
3. Press S1 a third time to return to routine detector operation (power LED flashing once per second).

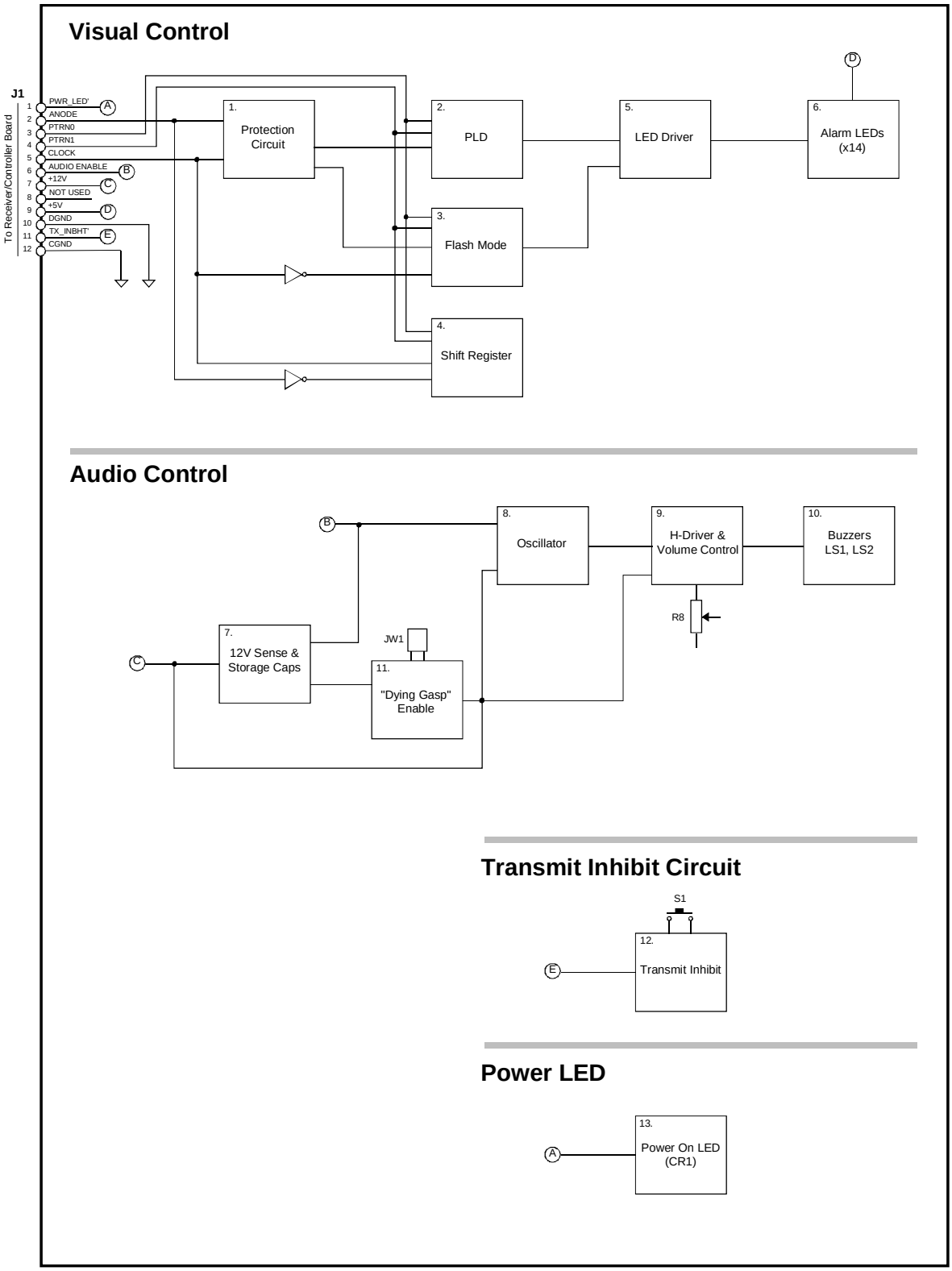
To discourage unauthorized tampering, an audible beep occurs each time S1 is pressed. This transmit inhibit feature can be disabled by the configurator software.

Power LED (13)

Power on LED CR1, located at the center of the LED ring, operates in one of three ways:

- Flashes once per second to indicate that ac power is applied to the detector and that the transmitter is operating (routine operation),
- Remains on continuously to indicate that the transmitter is disabled (diagnostics mode), or
- Flashes rapidly to indicate that the transmitter is indefinitely disabled (waiting for service).

Figure 8. Alarm board 0301-0810-01



Parts Lists and Drawings

This section contains parts and drawings for all serviceable parts. Parts lists are listed below; drawings are listed in part number order (see page 34).

Parts Lists

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0100-1065-01 SECONDARY UNIT EUROPEAN, PKG,U*P A0

Item	Qty	Part Number	Description
1	1	0300-1712-01	PEDESTAL ASSY,U*P,SLAVE, EUROPEAN
3	1	0649-1524-01	PACKAGING ASSY,U*P,PEDESTAL

0100-1071-01 U*P MASTER,EUROPEAN A0

Item	Qty	Part Number	Description
1	1	0100-1064-01	PRIMARY UNIT,EUROPEAN,PKG U*P
2	1	0351-0547-XX	POWER CORD OPTIONS

0100-1089-01 CRASH KIT U*P B0

Item	Qty	Part Number	Description
1	2	0400-0812-01	GUARD ASSY,BUMPER,J PLUS
2	2	0500-7387-01	CART GUARD,U*P
3	2	0500-7388-01	BOOT,U*P
4	1	0649-0006-05	BAG PLASTIC 10X24X84 MIL THK
5	1	2450-0008-01	LABEL,BLANK,PAPER,THERMAL,88.9X76.2

0100-1099-01 WEIGHTED BASE,U*P B0

Item	Qty	Part Number	Description
1	1	0500-7389-01	BASE,WEIGHTED,U*P
2	4	5842-0700-011	WSH,FL LOD,M8,ST,Z,9021B
3	4	5826-0600-011	NUT,LCK,M8,ST,Z,985
4	4	1401-0032-01	BMPR,RCSS,1/2DX3/8H,W/WSHR
5	1	0649-0006-30	BAG,PLASTIC
6	1	2450-0008-01	LBL,BLNK,PAP,THERM,89X76M,RL

0100-1101-01 U*P MASTER,NON-EUROPEAN A0

Item	Qty	Part Number	Description
1	1	0100-1102-01	PRIMARY UNIT,NON-EUROPEANPKG,U*P
2	1	0351-0547-XX	POWER CORD OPTIONS

0100-1103-01 SECONDARY UNIT,NON-EUR PKG,U*P B0

Item	Qty	Part Number	Description
1	1	0300-1712-02	PEDESTAL ASSY,U*P,SLAVE, NON-EUROPE
2	1	0351-1131-02	INSTALL KIT U*P,NON-EUROPEAN
3	1	0649-1524-01	PACKAGING ASSY,U*P,PEDESTAL

0300-1711-01 PED ASSY,U*P,MASTER,EUROPEAN G0

Item	Qty	Part Number	Description
1	1	0400-1143-01	CHASSIS-STIFFENER ASSY
2	2	0500-5384-03	BUMPER,EDGE
3	1	0300-1715-01	ALARM ASSY, U*P
4	4	5899-0002-103	SCR,TCUT,M4.2X13,PHP,ST,Z,T1
5	1	0301-0784-01	PCB ASSY,U*P,XMTR/POWERSUPPLY,EUR
6	1	0301-0785-02	PCB ASSY,U*P RECEIVER/CONTROLLER
7	2	0650-1805-01	CABLE ASSY,RCVR/XMTR,U*P
8	14	6009-0005	CBL TIE,NY,7-1/2 "
9	1	2101-0034-03	TBLK,EUR,12C,22-14,16A,2X3P
10	2	5801-1101-111	SCR,M,M3X25,PHP,ST,Z,7985
11	3	5826-0200-011	NUT,LCK,M3,ST,Z,985
12	8	2841-0074-02	FSNR,QTR TN,STD,OH,SWL,1.3-1.8
13	2	0500-6856-01	COVER,U*P
14	2	2402-0428-02	LABEL,SEC LOGO
15	1	0500-7261-01	BASE,PLATE,U*P
16	4	2841-0076-27	FSNR,QTR TURN,RCP,CLIP-ON,ST
17	4	2841-0082-11	FSNR,1/4T,STUD,OHP,14.6L,SNP
18	1	2402-0431-01	LABEL,NEUTRAL/LINE INDI- CATION,SSI
19	1	2402-0469-24	UNIVERSAL LABEL
22	1	0649-1545-02	RETAINER,PCB
23	.75	3200-0228-04	TAPE,PP,SSP,RB,.0016T2"W1K YD
27	1	5840-0200-011	WSH,FL,STD,M3,ST,Z,125A
28	1	0650-1972-01	CABLE ASSY,SHIELD INTERCONNECT
29	4	5801-2091-120	SCR,M,M4X20,PHP,S304,P,7985
30	4	5840-0300-020	WSH,FL STD,M4,S304,P,125A
31	4	5846-0300-020	WSH,SL,M4,S304,P,127B

0300-1711-02 PED ASY,U*P,MASTER,NON-EUROPEAN E0

Item	Qty	Part Number	Description
1	1	0500-6855-01	CHASSIS,U*P
2	2	0500-5384-03	BUMPER,EDGE
3	1	0300-1715-01	ALARM ASSY, U*P

4	4	5899-0002-103	SCR,TCUT,M4.2X13,PHP,ST,Z,T1
5	1	0301-0791-01	PCB ASSY,U*P,XMTR/POWERSUPPLY,NON
6	1	0301-0785-01	PCB ASSY,U*P RECEIVER/CONTROLLER
7	2	0650-1805-01	CABLE ASSY,RCVR/XMTR,U*P
8	14	6009-0005	CBL TIE,NY,7-1/2 "
9	1	2101-0034-03	TBLK,EUR,12C,22-14,16A,2X3P
10	2	5801-1101-111	SCR,M,M3X25,PHP,ST,Z,7985
11	2	5826-0200-011	NUT,LCK,M3,ST,Z,985
12	8	2841-0074-02	FSNR,QTR TN,STD,OH,SWL,1.3-1.8
13	2	0500-6856-01	COVER,U*P
14	2	2402-0428-02	LABEL,SEC LOGO
15	1	0500-7261-01	BASE,PLATE,U*P
16	4	2841-0076-27	FSNR,QTR TURN,RCP,CLIP-ON,ST
17	4	2841-0082-11	FSNR,1/4T,STUD,OHP,14.6L,SNP
18	1	2402-0431-01	LABEL,NEUTRAL/LINE INDI- CATION,SSI
19	1	2402-0469-26	LABEL,UNIVERSAL
22	1	0649-1545-01	RETAINER,PCB
23	.75	3200-0228-04	TAPE,PP,SSP,RB,.0016T2"W1K YD
24	2	0500-7276-01	STIFFENER,U*P
25	4	5801-3104-511	SCR,M,M5X25,HHH,ST,Z,933
26	4	5846-0400-011	WSH,SL,M5,ST,Z,127B
29	4	5801-2091-120	SCR,M,M4X20,PHP,S304,P,7985
30	4	5840-0300-020	WSH,FL STD,M4,S304,P,125A
31	4	5846-0300-020	WSH,SL,M4,S304,P,127B

0300-1712-01 PEDSTL ASY,U*P,SECONDARY, EURO E0

Item	Qty	Part Number	Description
1	1	0400-1143-01	CHASSIS-STIFFENER ASSY
2	2	0500-5384-03	BUMPER,EDGE
3	1	0500-6857-01	CAP,TOP W/O ALARM CUTOUT,U*P
4	4	5899-0002-103	SCR,TCUT,M4.2X13,PHP,ST,Z,T1
5	1	0301-0812-01	PCB ASSY,U*P CAP TUNER,EUROPEAN
6	2	2877-0006-13	RIV,CKTBR,SNAP,3.7-4.7M T,NY
7	2	2877-0006-01	STDF,CKTBR,SNAP,RIV,9.5M SP,NY
8	2	0650-1805-01	CABLE ASSY,RCVR/XMTR,U*P
9	14	6009-0005	CBL TIE,NY,7-1/2 "
10	1	0650-1809-01	CABLE ASSY,U*P,SLAVE
11	2	2841-0074-02	FSNR,QTR TN,STD,OH,SWL,1.3-1.8
12	2	0500-6856-01	COVER,U*P
13	2	2402-0428-02	LABEL,SEC LOGO
14	1	0500-7261-01	BASE,PLATE,U*P
15	4	2841-0076-27	FSNR,QTR TURN,RCP,CLIP-ON,ST
16	4	2841-0082-11	FSNR,1/4T,STUD,OHP,14.6L,SNP
17	1	2402-0469-25	LABEL,UNIVERSAL
21	4	5801-2091-120	SCR,M,M4X20,PHP,S304,P,7985
22	4	5840-0300-020	WSH,FL STD,M4,S304,P,125A
23	4	5846-0300-020	WSH,SL,M4,S304,P,127B

0300-1712-02 PED ASY,U*P,SECONDARY, NON-EURO E0

Item	Qty	Part Number	Description
1	1	0500-6855-01	CHASSIS,U*P
2	2	0500-5384-03	BUMPER,EDGE
3	1	0500-6857-01	CAP,TOP W/O ALARM CUTOUT,U*P
4	4	5899-0002-103	SCR,TCUT,M4.2X13,PHP,ST,Z,T1
5	1	0301-0816-01	PCB ASSY,U*P CAP TUNER,NON-EUROPEAN
6	2	2877-0006-13	RIV,CKTBR,SNAP,3.7-4.7M T,NY
7	2	2877-0006-01	STDF,CKTBR,SNAP,RIV,9.5M SP,NY
8	2	0650-1805-01	CABLE ASSY,RCVR/XMTR,U*P
9	14	6009-0005	CBL TIE,NY,7-1/2 "
10	1	0650-1809-02	CABLE ASSY,U*P,SLAVE,12M
11	2	2841-0074-02	FSNR,QTR TN,STD,OH,SWL,1.3-1.8
12	2	0500-6856-01	COVER,U*P
13	2	2402-0428-02	LABEL,SEC LOGO
14	1	0500-7261-01	BASE,PLATE,U*P
15	4	2841-0076-27	FSNR,QTR TURN,RCP,CLIP-ON,ST
16	4	2841-0082-11	FSNR,1/4T,STUD,OHP,14.6L,SNP
17	1	2402-0469-27	LABEL,UNIVERSAL
18	2	0500-7276-01	STIFFENER,U*P
19	4	5801-3104-511	SCR,M,M5X25,HHH,ST,Z,933
20	4	5846-0400-011	WSH,SL,M5,ST,Z,127B
21	4	5801-2091-120	SCR,M,M4X20,PHP,S304,P,7985
22	4	5840-0300-020	WSH,FL STD,M4,S304,P,125A
23	4	5846-0300-020	WSH,SL,M4,S304,P,127B

0300-1782-01 ASSY ANT,U*P FERRITE ANTENNA A0

Item	Qty	Part Number	Description
1	1	0500-4588-01	COVER,MOLDED,8.75*2.75
2	1	0500-4589-01	BASE TURBO,ANT
3	4	2848-0009-01	WSH,FL,NY,P,.140IDX.312ODX.047THK
4	4	2849-6650	WSH,SHLDR,NY,.141IDX.250ODX.093THK
5	4	2838-9115-09	NUT,HEX,FULL,EXLK,ZN,KEPS,6-32,#4 N
6	4	2870-0003	NUT,SPEED,U-TYPE,ST,P,6-32
7	1	0500-4554-01	COVER SHIELD
8	.25	0500-7947-01	ADHESIVE STRIP FERRITE ANTENNA
9	1	0301-0396-02	PCB ASSY,ULTRA POST FERRITE ANTENNA
11	1	2847-9300	WSH,SL,#10,ST,Z,REG
12	4	2804-7605-01	SCR,M,PHP,CAD,6-32X3/8
13	1	2834-0009-01	NUT,WING,ZN,10-32,LIGHT
14	1	2402-0469-40	LABEL,U*P FERRITE RCVR ANTENNA
18	1	0649-1482-01	PKG ASSY,TURBO ANTENNA,INTERNAL

0301-0784-01 PCB,U*P,XMTR/POWERSUPPLY,EUR C0

Item	Qty	Part Number	Description
1	1	1700-1022-01	PCB,U*P,XMTR/POWER SUPPLY,EUROPEAN
2	1	4800-0081-01	DIODE,ZENER,4750A,27V,5%,1W,AXIAL,CR1
3	2	4800-0026	DIODE,ZENER,5358B,22V,5%,5W,AXIAL,CR2,3
4	5	4800-0105-01	DIODE,RECT,FAST,RECOVERY,1A,200V,DO, CR4-6,29,30
5	3	4800-0134-01	DIODE,RECT,1100E,1KV,1A,ULTRA-FAST, CR7,32,43
6	2	4800-0080-01	DIODE,RECT,460,600V,4A,AXIAL,CR8,9
7	4	4800-0038-01	DIODE,GP,4148,1V,10MA,AXIAL,CR10,19,44,50
8	7	4800-0069-01	DIODE,SCHTKY,150,50V,1A,AXIAL, CR11,20,34,35,38,39,46
9	11	4800-0039-01	DIODE,ZENER,751A,5.1V,5%,500MW,AXIA, CR12-14,17,18,21-23,26,27,45
10	4	4800-0062-01	DIODE,ZENER,5240B,10V,5%,500MW,AXIA, CR15,16,24,25
11	1	4803-0018-01	BRIDGE RECT,8A,600V MIN.,4 PIN SIP,CR28
12	1	4800-0071-01	DIODE,RECT,745,45V,7.5A,TO-220,CR31
14	1	4800-0076-01	DIODE,RECT,305,400V,3A,AXIAL,CR33
15	1	4800-0102-01	DIODE,RECT,4004,400V,1A,AXIAL,CR40
16	1	4800-0079-01	DIODE,ZENER,4744A,15V,5%,1W,AXIAL,CR41
17	3	4800-0010	DIODE,RECT,4003,200V,1A,AXIAL,CR36,37,42
18	1	1536-0009-01	CAP,47UF,50V,20%,LLEL,RADIAL,3.5MML,C1
19	1	1510-0062	CAP,.22UF,100V,10%,MPET,BOX,C3
20	21	1508-0033-01	CAP,.1UF,50V,20%,CM,RAD,Z5U,.1LS(T&, C5,6,7,13,17-20,50,51,58,6769,73,74,82,86, 88,91,106
21	1	1508-0107-01	CAP,.047UF,50V,10%,CM,RAD,X7R,C8
22	1	1508-0054-01	CAP,.01UF,1KV,20%,CD,RAD,Z5U,.375LS,C9
23	2	1536-0014-01	CAP,10UF,25V MIN.,20%,LLEL,RADIAL,(, C10,109
24	2	1540-0179-01	CAP,2200UF,63V,20%,ALEL,RAD,10LS,C11,12
26	17	1508-0063-01	CAP,.1UF,100V,10%,CM,RAD,X7R,.1LS, C15,16,45-47,53-56,63,70-72,102-105
27	2	1510-0187-01	CAP,1000PF,1250V,10%,PP,BOX,15MMLS, C28,34
28	2	1510-0192-01	CAP,.022UF,1KVDC/400VAC,PP,BOX,22.5, C25,26
29	2	1510-0186-01	CAP,.01UF,1250V,5%,PP,BOX,22.5MMLS, C27,32
30	1	1510-0289-01	CAP,1UF,250VAC,20%,MPET,RAD,X2,SAFE, C119
31	2	1510-0199-01	CAP,2200PF,1KV,10%,PP,BOX,15MMLS, C29,35
32	2	1510-0194-01	CAP,.0033UF,1KV,10%,PP,BOX,15MMLS, C30,33
33	2	1510-0190-01	CAP,4700PF,1250V,5%,PP,BOX,15MMLS, C31,36
34	2	1507-0010-01	CAP,330PF,50V,10%,CM,AX,X7R,C37,57
35	2	1507-0008-01	CAP,150PF,100V,5%,CM,AX,NPO,C41,59
36	1	1536-1058	CAP,1UF,50V,20%,LLEL,RAD,.079LS,C39
37	1	1508-0096-01	CAP,.027UF,50V,10%,CM,RAD,X7R,.2LS,C110
38	4	1508-0081-01	CAP,1000PF,50V,5%,CM,RAD,NPO, C42,43,60,61
40	2	1508-0123-01	CAP,.022UF,100V,10%,CM,RAD,X7R,.2LS, C44,62
41	3	1508-0098-01	CAP,470PF,200V,10%,CM,RAD,X7R,(T&R),

			C48,64,78
42	2	1508-0064-01	CAP,10PF,100V,5%,CM,RAD,NPO,.1LS,C49,65
43	6	1508-0092-01	CAP,18PF,200V,10%,CM,RAD,X7R, C14,52,66,125-127
44	3	1540-0111-01	CAP,1000UF,10V,20%,ALEL,RAD,LOW ESR, C75,76,99
45	1	1507-0013-01	CAP,680PF,50V,10%,CM,AX,X7R,C107
46	1	1536-0016-01	CAP,330UF,35V,20%,LLEL,RAD,C2
47	7	1540-0050-01	CAP,100UF,35V MIN,20%,ALEL,RAD,.2LS, C83-85,87,89,90,98
48	1	1540-0086-01	CAP,47UF,35V MIN,20%,ALEL,RAD,C92
49	1	1508-0102-01	CAP,1UF,50V,20%,CM,RAD,Z5U,.2LS,(T&,C93
50	2	1508-0047-01	CAP,47PF,100V,5%,CM,RAD,NPO,.100LS, C116,117
51	2	1540-0174-01	CAP,220UF,200V,20%,ALEL,SNAP MT,10L, C95,96
52	8	1508-0067-01	CAP,.01UF,100V,10%,CM,RAD,X7R,.2LS, C81,97,100,101,108,112-114
53	10	1508-0048-01	CAP,.001UF,100V,10%,CM,RAD,X7R,(T&R, C21-24,77,111,123,124,128,129
54	2	1508-0151-01	CAP,2200PF,250VAC,20%,CD,RAD,Y-TYPE, C120,121
55	1	1510-0169-01	CAP,2.2UF,250VAC,20%,MPET,RAD,X-TYP, C122
56	2	5110-0018-01	FUSE CLIP,6.3A,500V,5MM,PCMT
57	1	2900-0049-01	HEATSINK,TO-220,1.5HX1.38WX.5THK,SL,HS1
58	2	0500-3956-01	HEATSINK,SWITCH BRD,HS2,3
59	9	2104-0036-12	SOCKET,STRIP,.040,FEMALE,1X2POS,.2C, JW1-8,11
60	2	0650-0907-01	CURRENT SENSE LOOP
61	1	2109-0447-18	CONN,CE,W/O EARS,.100CTR,R/A,2X18PO,J1
66	1	2190-0019-01	POWR ENTRY MODULE,250V,3A,FLTR,IEC,P1
67	1	2109-0252-04	CONN,HDR,LKG,.156CTR,4POS,TIN/BR,P2
68	4	2109-0252-12	CONN,HDR,LKG,.156CTR,12POS,TIN/BR,P3-6
69	3	2103-0029	TERM,Q/D,.250X.032,TAB,PCMT,TIN/BR, P8,9,11
70	1	4840-0035	XSTR,NPN,102,DARL,100V,8A,TO-220AB,Q1
71	16	4830-0067-01	XSTR,PNP,3906,AMP,40V,200MA,TO-92, Q2,8,9,20-24,27,32-36,39,45
72	4	4830-0087-01	XSTR,NPN,2222A,AMP,40V,500MA,TO-92, Q3-5,7
73	2	4840-0118-01	XSTR,MOSFET,N-CH,1000V,3A,4 OHMS,TO, Q6,43
74	4	4860-0014-01	TRIAC,400V MIN,15A,HIGH DV/DT,TO-22, Q10-13
75	6	4830-0052-01	XSTR,NPN,5550,HV SW,140V,600MA,TO-9, Q14-16,29,41,42
76	7	4830-0066-01	XSTR,PNP,5415,AMP,200V,1A,TO-39, Q17,25,26,28,37,38,40
77	4	4840-0038-01	XSTR,MOSFET,520,N-CH,100V,7A,TO-220, Q18,19,30,31
79	1	4745-0007-01	THERMISTOR,NTC,CURRENT LIMITING,4A, RT1
80	1	4745-0008-01	THERMISTR,PTC,SURFACE TEMP SENSING, RT2
81	1	4815-0019-01	VARISTR,275V,4500A,RADIAL,VDE APPR, RV1
82	3	4711-2201-700	RES,2.2K OHM,5%,.25W,CFM,R1,31,89
83	1	4751-0046-05	POT,500 OHM,.5W,25T,PCMT,V-ADJ,R17
84	4	4711-5007-700	RES,.5 OHM,5%,.25W,CFM,R3,4,189,192
85	4	4711-4709-700	RES,47 OHM,5%,.25W,CFM,R38,39,42,43
86	7	4711-1001-700	RES,1K OHM,5%,.25W,CFM, R6,8,10,150,152,168,171
87	5	4721-1001-500	RES,1K OHM,1%,.25W,MF,R56,80,83,109,183
88	1	4721-2491-500	RES,2.49K OHM,1%,.25W,MF,R9
89	1	4721-1623-500	RES,162K OHM,1%,.25W,MF,R11
90	1	4721-9091-500	RES,9.09K OHM,1%,.25W,MF,R12
91	8	4711-1009-700	RES,10 OHM,5%,.25W,CFM, R13,14,16,104,105,138,139,175
92	1	4711-2409-700	RES,24 OHM,5%,.25W,CFM,R151
93	1	4721-5231-500	RES,5.23K OHM,1%,.25W,MF,R162
94	15	4711-1002-700	RES,10K OHM,5%,.25W,CFM,R20,21,23,24, 29,32,36,77,88,97,137,140,160,176,185
95	8	4711-1003-700	RES,100K OHM,5%,.25W,CFM, R22,27,76,81,92,135,179,195
96	1	4711-8201-700	RES,8.2K OHM,5%,.25W,CFM,R25
97	4	4711-3301-700	RES,3.3K OHM,5%,.25W,CFM,R26,28,167,174
98	7	4711-3302-700	RES,33K OHM,5%,.25W,CFM, R30,67,90,120,133,170,173
99	8	4711-5101-700	RES,5.1K OHM,5%,.25W,CFM, R7,33,35,73,78,98,126,156
100	4	4721-1211-500	RES,1.21K OHM,1%,.25W,MF,R44-47
101	8	4736-0042-01	RES,8 OHM,5%,5W,WW,R48-55
103	2	4721-4421-500	RES,4.42K OHM,1%,.25W,MF,R57,110
104	2	4721-3010-500	RES,301 OHM,1%,.25W,MF,R59,112
105	6	4711-7509-700	RES,75 OHM,5%,.25W,CFM,R60-62,113-115
106	4	4711-6801-700	RES,6.8K OHM,5%,.25W,CFM,R63,66,116,119
107	4	4711-6809-700	RES,68 OHM,5%,.25W,CFM,R64,65,117,118
108	4	4711-2709-700	RES,27 OHM,5%,.25W,CFM,R68,86,121,144
109	2	4721-5629-500	RES,56.2 OHM,1%,.25W,MF,R69,122
110	6	4711-2400-700	RES,240 OHM,5%,.25W,CFM, R70,75,87,123,128,132
111	2	4711-3900-700	RES,390 OHM,5%,.25W,CFM,R71,124
112	2	4751-0074-01	POT,1K OHM,10%,.5W,S/T,PCMT,V-ADJ, R72,125
113	2	4711-5102-700	RES,51K OHM,5%,.25W,CFM,R74,127
114	7	4721-3011-500	RES,3.01K OHM,1%,.25W,MF, R79,84,94,100,129,130,136
115	1	4721-1000-500	RES,100 OHM,1%,.25W,MF,R82
116	1	4721-4993-500	RES,499K OHM,1%,.25W,MF,R184
117	2	4721-5620-500	RES,562 OHM,1%,.25W,MF,R91,134
118	1	4721-9090-500	RES,909 OHM,1%,.25W,MF,R93
119	1	4721-3242-500	RES,32.4K OHM,1%,.25W,MF,R96
120	6	4721-2001-500	RES,2K OHM,1%,.25W,MF, R107,108,141,143,169,172
121	2	4721-4991-500	RES,4.99K OHM,1%,.25W,MF,R153,161
122	2	4721-1212-500	RES,12.1K OHM,1%,.25W,MF,R106,142
123	2	4701-0000-000	RES,0 OHM,.25W SIZE,STL SLG TYPE, R15,166
124	1	4711-2208-700	RES,2.2 OHM,5%,.25W,CFM,R145
125	1	4711-9102-700	RES,91K OHM,5%,.25W,CFM,R191
126	1	4711-3600-700	RES,360 OHM,5%,.25W,CFM,R149
127	7	4711-5100-700	RES,510 OHM,5%,.25W,CFM, R5,34,37,58,103,111,180
129	4	4712-1803-700	RES,180K OHM,5%,.5W,CFM, R157,158,163,164
130	1	4712-3603-700	RES,360K OHM,5%,.5W,CFM,R194
132	1	4711-3303-700	RES,330K OHM,5%,.25W,CFM,R177
134	2	4721-3650-500	RES,365 OHM,1%,.25W,MF,R19,182
136	3	4725-2001-700	RES,2K OHM,5%,3W,MOF,R18,186,187
137	2	2108-0021-01	TEST POINT,JUMPER,.100 CTR,TP15,16
138	4	3130-0727-01	IC,OPTO-COUPLER,410,TRIAC-DRVR,600V, U5,6,7,8
140	2	3130-0711-01	IC,OPTO-COUPLER,CNY17-1,40CTR MIN,V, U1,15
141	1	3130-0076-01	IC,SCHMITT TRIGGER,HC132,QUAD,NAND,U2
142	3	3130-0262-01	IC,REFERENCE,431A,VOLT,1%,2.5 to 36, U3,9,16
143	1	3130-0339	IC,COMPARATOR,339,QUAD,DIP14,U4
145	3	3130-0197-01	IC,AMPLIFIER,833,OP,DUAL,AUDIO,DIP0, U10,12,13
146	1	3130-0130-01	IC,SWITCH,211,ANALOG,QUAD,SPST,DIP1, U11
147	1	3130-0710-01	IC,MODULATOR,3842A,PWM,DIP8,U14
148	1	3130-1019	IC,REGULATR,7812,VOLTAGE,POS,12V,T,U17
149	1	3130-0142-12	IC,REGULATR,79M12,VOLTAGE,12V,NEG,U18
150	1	2900-0029-01	HEATSINK,TO-220,.37X.90X.7FINS,CLIP
152	2	1508-0152-01	CAP,220PF,100V,10%,CM,RAD,X7R,.1LS, C38,79
153	1	1508-0055-01	CAP,3300PF,1KV,20%,CD,RAD,Z5U,.25LS,C94
155	1	1510-0189-01	CAP,220PF,1600V,10%,PP,BOX,15MMLS,C115
157	1	1508-0045-01	CAP,330PF,100V,5%,CM,RAD,NPO,C4
158	1	5112-0011-19	FUSE,2A,250V,5X20MM,F/B,SEMKO,F1
161	1	4830-0111-01	XSTR,NPN,18,DARL,45V,200MA,T0-92,Q44
162	1	5604-0166-01	XFMR,MAIN,XMTR PWR SUPPLY,ULTRA POS, T1
163	1	5604-0167-01	XFMR,LOW VOLTAGE,XMTR PWR SUPLY,UL, T2
167	1	4736-5211-01	RES,2.2K OHM,5%,1W,WW,R40
168	3	4743-0012-01	RES,33K OHM,5%,2W,MOF,MINIATURE, R2,146,190

169	2	4721-4751-500	RES,4.75K OHM,1%,.25W,MF,R148,154
170	1	4711-2200-700	RES,220 OHM,5%,.25W,CFM,R155
172	1	4743-0014-01	RES,100K OHM,5%,2W,MOF,MINIATURE,R178
174	1	3130-0471-01	IC,OPTO-COUPLER,4502,19%CTR,HI SPEE, U19
176	4	5887-1122-030	STDF,HX,MF,M3X19,WAF6,AL,P
177	1	0500-7996-01	PLATE,DRIP U*P FAN
178	1	0500-7278-01	COVER LPA U*P
179	1	0500-7277-01	SHEILD,LPA U*P
180	1	0500-7415-01	SHEILD,BOTTOM LPA
181	1	0500-7418-01	INSULATOR,LPA
182	12	5801-1041-111	SCR,MACH,M3X6,PHP,ST,Z,7985
183	4	5801-1061-120	SCR,MACH,M3X10,PHP,SS304,P,7985
184	4	5850-0200-020	WSH,INT TH,M3,SS304,P,6797J
185	6	5826-0200-011	NUT,LCK,M3,ST,Z,985
186	1	2886-0003	PLUG,HOLE,BR,N,1.00DIA
187	1	2402-0459-01	LABEL,VOLTAGE WARNING
188	6	2870-0018-01	NUT,SPEED,U-TYPE,ST,Z,#2062 LESS SC
189	4	2876-0044-03	SPCR,RD,.250ODX.187L,.140ID,AL,P
190	1	3502-0020-01	FAN,52X10,9.2CFM,12VDC
192	1	4800-0118-5R6	DIODE,ZENER,5339A,5.6V,5W,AXIAL,CR47
193	2	4800-0118-62	DIODE,ZENER,5372,62V,10%,5W,CR48,49
194	3	1800-0017	IND,330UH,10%,110MA,MOLDED,SHIELDED, L1,2,4
195	1	1800-0035	IND,500UH,25%,350MA,SHIELDED,AXIAL,L3
196	2	4721-1002-500	RES,10K OHM,1%,.25W,MF,R95,101
198	8	2109-0062-01	SHUNT,PLUG,.200CTR,.040DIA,2POS,AU/
199	1	1800-0151-01	IND,34MH,25%,4.5A,COMMONMODE,PCMT,T3
200	1	0650-1840-01	CABLE ASSY,U*P FILTER NET
201	1	0650-1840-02	CABLE ASSY,U*P FILTER HOT
202	1	0650-1840-03	CABLE ASSY,U*P FILTER GRD
203	7	4859-0002	PAD,MTG,XSTR,TO-5,.075THK
204	1	5801-1051-140	SCR,MACH,M3X8,PHP,NY,P,7985
205	1	5820-0200-040	NUT,HEX,M3,NY,P,934
206	6	2902-0010-02	INSULATOR,TO-220,THERMAL CONDUCTIVE
207	6	2510-0006	BUSHING,INSUL,NYLON,TO-220
208	1	4721-1502-500	RES,15K OHM,1%.25W,MF,R102
209	1	4721-1501-500	RES,1.5K OHM,1%,.25W,MF,R99

0301-0785-01 PCB ASY,U*P RECEIVER/CONTROLLER E1

Item	Qty	Part Number	Description
1	1	1700-1015-01	PCB,U*P RECEIVER/CONTROLLER
2	15	4805-0020-01	DIO,SW,914,70V,10M,4NS,SOT23,CR2-15,18
3	7	1509-1032-161	CAP,.01UF,100V,10%,X7R,1206, C6-8,19,34,63,158
4	2	1545-0001-01	CAP,100UF,35V,20%,AL,6.3X8,C94,96
5	79	1509-1043-571	CAP,.1UF,50V,20%,Z5U,1206, C11,14,17,20,21,24,26,27,30,31,33,36,37,39,43-53,56-59,61,62,64-71,80,82,84-87, 89,97-100, 103,106-108,113,114,131-133,139,140,143, 144,147,148,150-152,160,162,167-173,183,184
6	11	1545-0005-01	CAP,10UF,25V,20%,AL,5X5.5, C18,22,32,35,38,88,104,105,129,130,164
7	1	1509-2733-571	CAP,.027UF,50V,20%,Z5U,1206,C23
8	2	1509-3311-151	CAP,330P,100V,5%,NPO,1206,C25,134
9	2	1509-4711-551	CAP,470P,50V,5%,NPO,1206 ,C185,186
10	5	1509-2242-361	CAP,.22UF,25V,10%,X7R,1206,C1-5
11	3	1509-1521-551	CAP,1500P,50V,5%,NPO,1206,C40,41,109
12	1	1509-6811-151	CAP,680P,100V,5%,NPO,1206,C42
13	6	1509-1031-552	CAP,.01UF,50V,5%,NPO,1210, C60,149,154-156,165
14	13	1509-1022-161	CAP,1000P,100V,10%,X7R,1206, C10,13,16,72-79,81,83
15	15	1535-1050-722	CAP,1UF,35V,20%,TAN,3528, C90-93,95,101, C102,111,112,121,122,125,126,174,175
16	10	1509-0021-01	CAP,47P,100V,5%,NPO,1206, C115,116,153,166,176-181
17	17	1509-1822-541	CAP,1800P,50V,2%,NPO,1206, C28,117-120, C123,124,127,128,135-138,141,142,145,146
18	3	4821-0002-03	LED,YW,2.6V,10M,0.4M,SOT23,DS4,5,7
20	1	2109-0476-12	CON,HDR,SHR,R/A,2.5,1X12P,6.1L,J3
21	1	2109-0480-01	CON,MDR,JCK,HST,4P/4C,VT,H-T,J4
23	1	4500-0019-01	REL,DPDT,5V,1A/125VAC,10P,SMD,K1
24	2	1801-0003-01	IND,10UH,10%,210M,1008,SMD,L1,2
25	1	4845-0004-01	XSTR,PNP,3906,40V,.2A,SOT23,Q1
26	10	4730-0006-35	RESN,10K,5%,.06W,BUS,10P ,RN1-10
27	1	4752-0004-103	POT,10K,20%,.25W,S/T,V,SMD,JL,R59
28	2	4752-0004-203	POT,20K,20%,.25W,S/T,V,SMD,JL,R19,27
29	18	4780-2200-700	RES,220,5%,1/8W,TF,1206,R1-5,47,52,180,181,187-192,204-206
31	1	4780-3300-700	RES,330,5%,1/8W,TF,1206,R7
32	15	4780-4701-700	RES,4.7K,5%,1/8W,TF,1206, R8,9,11,12,35,43, R45,46,48,53,176,177,179,214,215
33	6	4780-0000-700	RES,0,5%,1206,R32,33,171,178,213,216
34	1	4780-8200-700	RES,820,5%,1/8W,TF,1206,R51
35	1	4780-3403-500	RES,340K,1%,1/8W,TF,1206 ,R14
36	1	4780-2709-700	RES,27,5%,1/8W,TF,1206,R15
37	1	4780-1331-500	RES,1.33K,1%,1/8W,TF,1206,R16
38	9	4780-3011-500	RES,3.01K,1%,1/8W,TF,1206, R17,61,64-66,69-71,76
39	1	4780-6341-500	RES,6.34K,1%,1/8W,TF,1206,R18
40	10	4780-4751-500	RES,4.75K,1%,1/8W,TF,1206, R20,57,88,119-123,158,184
41	3	4780-2431-500	RES,2.43K,1%,1/8W,TF,1206,R21,24,25
42	1	4780-3401-500	RES,3.4K,1%,1/8W,TF,1206 ,R23
44	1	4780-1622-500	RES,16.2K,1%,1/8W,TF,1206,R28
45	2	4780-1152-500	RES,11.5K,1%,1/8W,TF,1206,R29,56
46	1	4780-3242-500	RES,32.4K,1%,1/8W,TF,1206,R30
47	9	4780-1472-500	RES,14.7K,1%,1/8W,TF,1206, R31,93,96,99,102,105,109,111,115
48	19	4780-1002-500	RES,10K,1%,1/8W,TF,1206, R6,22,34,36-38,41, R42,60,118,129,159,160,162-167
50	1	4780-5909-500	RES,59,1%,1/8W,TF,1206,R44
51	4	4780-2490-500	RES,249,1%,1/8W,TF,SMD,1206, R49,50,169,170
52	1	4780-1871-500	RES,1.87K,1%,1/8W,TF,1206,R81
53	4	4780-4752-500	RES,47.5K,1%,1/8W,TF,1206,R54,85,86,92
54	1	4780-1211-500	RES,1.21K,1%,1/8W,TF,1206,R55
55	30	4780-1001-500	RES,1K,1%,1/8W,TF,SMD,1206, R13,44,58,62,63,67,68,72-75,84,87,90,,R97,98, 103,104,107,108,113,114,117,161, 193-196,217,269
56	1	4780-2940-500	RES,294,1%,1/8W,TF,SMD,1206,R78
57	2	4780-3572-500	RES,35.7K,1%,1/8W,TF,1206,R79,80
58	1	4780-4999-500	RES,49.9,1%,1/8W,TF,1206 ,R82
59	7	4780-4420-500	RES,442,1%,1/8W,TF,SMD,1206,R83,207-212
60	1	4780-9091-500	RES,9.09K,1%,1/8W,TF,1206,R89
61	1	4780-2051-500	RES,2.05K,1%,1/8W,TF,1206,R91
62	10	4780-2102-500	RES,21K,1%,1/8W,TF,1206, R94,95,100,101,106,110,112,116,127,128
63	3	4780-5361-500	RES,5.36K,1%,1/8W,TF,1206,R124-126
66	1	4780-5230-500	RES,523,1%,1/8W,TF,1206,R130
67	8	4780-4990-500	RES,499,1%,1/8W,TF,1206, R26,131,136,145,146,168,185,186
68	8	4780-2941-500	RES,2.94K,1%,1/8W,TF,1206, R132-135,141-144
69	6	4780-8871-500	RES,8.87K,1%,1/8W,TF,1206,R39,40,137-140
70	2	4780-4531-500	RES,4.53K,1%,1/8W,TF,1206,R147,148
71	4	4780-3832-500	RES,38.3K,1%,1/8W,TF,1206,149-152
72	1	4780-2052-500	RES,20.5K,1%,1/8W,TF,1206,R153
73	1	4780-2261-500	RES,2.26K,1%,1/8W,TF,1206,R154
74	1	4780-9531-500	RES,9.53K,1%,1/8W,TF,1206,R155
75	2	4780-2001-500	RES,2K,1%,1/8W,TF,SMD,1206,R156,157
77	13	4780-1000-700	RES,100,5%,1/8W,TF,1206, R172-175,182,183,197-203
78	27	2108-0030-01	TEST PT,SMD,LOOP,3/16X.089 PAD, TP1-3,5,7,9-20,22,23,25,26,33,35-38,43
79	5	3135-0096-01	IC,SW,211,ANLG,QD,SPST,SO16, U1,2,10,13,21
80	2	3135-0059-01	IC,AMP,347,OP,JFET,QD,SO14,U12,20
81	1	3135-0264-01	IC,SW,642,ANLG,VID,SO8,U4
82	3	3135-0263-01	IC,AMP,33079,OP,LO-N,QD,SO14,U3,5,6
83	1	3135-0049-01	IC,AMP,353,JFET,13V/US,DL,S08,U7
84	2	3135-0095-01	IC,AMP,074,OPQD,LO-N,SO14,U8,9
85	1	3135-0007-01	IC,GATE,HC02,QD,2-INP,NOR,S014,U11
86	1	3135-0003-01	IC,CMPRTR,393,V,DL,S08,U14
87	1	3135-0139-01	IC,AMP,833,OP,DL,AUD,SO8 ,U19
88	1	3135-0051-01	IC,REGL,78L05,+5V,.1A,SO8,U16
89	1	3135-0141-01	IC,SCHMT TRG,132,QD,NAND,SO14,U17

90	1	3135-0016-01	IC,BUFF,HC125,QD,LO-E,N/I,S014,U18
91	1	0701-2378-0100	PLD,PROGRAMED,U*P FLASH DOWNLOAD E, U22
92	1	3135-0144-01	IC,MVB,HC4538,MONO,RETRG,SO16,U23
93	1	3135-0001-01	IC,PLL,HC4046,SO16,U24
94	1	3135-0279-01	IC,CNV,0800,D/A,8B,S016,U25
95	1	3135-0057-01	IC,REGL,431,ADJ SHUNT,SO8,U26
96	1	3135-0273-01	IC,PGA,5202,2.5KGATE ARR,PLC84,U27
97	1	3135-0276-01	IC,MULTIPLIER,633,ANLG,4QD,SO8,U28
98	2	3135-0148-01	IC,SRAM,6264,8KX8,100NS,SO28X,U15,29
99	1	0701-2377-0210	EPROM,PROGRAMED,U*P APLLICATION CO, U30
100	1	2104-0051-44	SKT,IC,44P,PLC,SMD
101	1	3135-0288-01	IC,MCU,68HC16,16B,N-ROM,QFP132,U31
102	1	3135-0275-01	IC,EEPRM,25010,128X8,SER,SO08,U32
103	1	3135-0039-01	IC,DRV/RCV,DL,RS232,5V,SO16W,U33
104	2	3135-0142-01	IC,BUFF,HC244,OC,3S,N/I,SO20W,U34,35
105	1	3135-0151-01	IC,UNDR-V SENSE,4.6,W/DIO,S08,U36
106	1	3140-0027-01	OSC,SMD,16.384M,.01%,W/E,4P,JL,Y1
107	2	4805-0022-06	DIO,Z,5231,5.1V,5%,225MW,SOT23,CR16,17
108	3	1545-0004-01	CAP,470UF,16V,20%,AL,8X10.8,C9,12,15
109	1	1509-1511-551	CAP,150P,50V,5%,NPO,1206 ,C182
110	5	1509-1011-551	CAP,100P,50V,5%,NPO,1206, C29,157,159,161,163
111	2	4821-0002-01	LED,RD,2.6V,10M,0.4M,SOT23,DS1,3
112	2	4821-0002-02	LED,GN,2.6V,10M,0.4M,SMD,SOT23,DS2,6
113	6	1801-0018-01	FLTR,EMI,FR,120 OHM,@100M,0805,FB1-6
114	1	2101-0061-08	TBLK,EUR,3.5C,28-16,8P,55D,J2
115	2	2109-0475-30	CON,RCP,BRDBR,2C,2X15P,VT,J7,8
116	1	2104-0017-01	CON,HDR,.1C,2X3P,.230L,AU,J9
118	1	4816-0001-01	SUPPR,V,6.8V,10M,600W,U-D,SMB,CR1

0301-0791-01 PCB ASY,U*P,XMTR/PWR SUPPLY,NON E0

Item	Qty	Part Number	Description
1	1	1700-1031-01	PCB,U*P,XMTR/PWR SPLY,NON-EURO SSI
2	1	4803-0018-01	BRIDGE RCT,8A,600V MIN.,S4,CR1
3	2	4800-0039-01	DIO,Z,751A,5.1V,5%,500MW,AX,CR39,40
4	9	4800-0069-01	DIO,SHKY,150,50V,1A,AX, CR2,3,6,7,10,37,38,41,42
5	1	4800-0041-01	DIO,RC,4007,1000V,1A,AX,CR4
6	1	4803-0003	BRIDGE RCT,1A,140V MINIMUM,D4,CR5
9	1	4800-0065-01	DIO,Z,5245B,15V,5%,500MW,AX,CR9
11	4	4800-0080-01	DIO,RC,460,600V,4A,AX,CR14-17
12	4	4800-0118-75	DIO,Z,5374,75V,10%,5W,AX ,CR18,19,21,22
13	2	4800-0016	DIO,Z,5221,2.4V,10%,500MW,AX,CR20,31
14	4	4800-0038-01	DIO,GP,4148,1V,10M,AX,CR25-28
15	4	4800-0081-01	DIO,Z,4750A,27V,5%,1W,AX, CR29,CR30,CR32,CR33
16	1	4800-0118-5R6	DIO,Z,5339A,5.6V,5W,AX,CR34
17	2	1540-0178-01	CAP,470UF,200V,20%,AL,SP/M,RD,C1,2
18	3	1508-0055-01	CAP,3300P,1KV,20%,R,Z5U,1/4S,C65-67
19	4	1536-0009-01	CAP,47UF,50V,20%,LL,3.5S ,C8,12,17,36
20	14	1507-0001-01	CAP,.1UF,50V,20%,AX,Z5U,C13,15,18,22,24,26 ,53,54,59,64,99,,C100,101,102
21	2	1507-0015-01	CAP,1UF,50V,20%,AX,Z5U,C7,49
22	3	1540-0050-01	CAP,100UF,35V MIN,20%,AL,.2S,C14,50,98
23	2	1540-0111-01	CAP,1000UF,10V,20%,AL,5S,L-ESR,C19,21
24	4	1508-0098-01	CAP,470P,200V,10%,R,X7R,T/R, C46,51,108,109
25	1	1507-0008-01	CAP,150P,100V,5%,AX,NPO,C43
26	2	1508-0067-01	CAP,.01UF,100V,10%,R,X7R,.2S,C62,63
27	1	1508-0081-01	CAP,1000P,50V,5%,R,NPO,C45
28	1	1510-0157-01	CAP,2UF,250V,10%,MPET,AX ,C30
29	7	1510-0341-01	CAP,.047UF,400V,10%,PP,BX,15S, C31,34,35,37,38,41,42
30	2	1508-0117-01	CAP,680P,3KV,20%,R,Y5U,C32,33
31	6	1508-0091-01	CAP,.1UF,50V,10%,R,X7R,.2S,T/R, C39,40,110-113
32	7	1507-0001-02	CAP,.01UF,50V,20/80%,AX,Z5U, C47,52,56,60,61,96,97
33	2	1507-0002-01	CAP,2200P,50V,2%,AX,NPO,C55,25
34	2	1508-0151-01	CAP,2200P,250VAC,20%,R,Y-TYPE,C106,107
35	2	1540-0113-01	CAP,1000UF,35V,20%,AL,R,L-ESR,C10,16
36	8	1507-0011-01	CAP,1000P,50V,10%,AX,X7R ,C68-75
37	4	1510-0322-01	CAP,.068UF,500VAC,5%,PP,RD,C76,77,86,87
38	8	1510-0190-01	CAP,4700P,1250V,5%,PP,BX,15S, C78,79,82,83,88,89,92,93
39	4	1510-0199-01	CAP,2200P,1KV,10%,PP,BX,15S,C80,81,90,91
40	4	1510-0186-01	CAP,.01UF,1250V,5%,PP,BX,22S,C84,85,94,95
41	1	5111-0018-14	FUS,3A,250V,5X20,SB,UL/CSA,F1
42	3	2900-0060-01	HSNK,TO220,25.4HX35W,PC,HS3,5,6
43	2	2900-0042-01	HSNK,TO218,DL,W/PADS & CLIPS,HS2,4
44	11	2104-0036-12	SKT,STRIP,.04,FEM,2P,.2C,BK-AW,JW1-11
45	1	2109-0447-18	CON,CE,.1C,R/A,2X18P,J1
46	1	2700-0031-02	FLTR,LN,2A,250V,PC,LF1
48	1	1800-0035	IND,500UH,20%,350M,SHLD,AX,L2
50	3	1800-0183-01	IND,4.7UH,5A/RMS@58KH,TOR,PC,L5-7
51	1	2150-0012-01	PW ENTRY,250V/6A,MLE,R/A,PC,P1
52	1	2109-0252-04	CON,HDR,LK,.157C,4P,,P2
53	3	2103-0029	TM,QD,1/4X.032,TAB,PC,P3-5
54	4	2109-0125-11	CON,HDR,LK,.157C,12P,,P8-11
55	6	2104-0035-01	CON,HDR,2.54C,2P,5.97L,AU,J2-7
56	1	4840-0038-01	XSTR,MFET,520,N,100V,7A,TO220,Q1
57	1	4830-0111-01	XSTR,NPN,18,DAR,45V,200M,T0-92,Q2
58	16	4830-0087-01	XSTR,NPN,2222A,40V,500M,TO92, Q3,9,14-18,21,24,26,37,41,42,46-48
59	1	4830-0088-01	XSTR,PNP,2907A,60V,600M,TO92,Q25
60	6	4860-0014-01	TRIAC,400V,15A,HI DV/DT,TO220, Q6,Q19,Q32,Q33,Q34,Q35
61	2	4840-0089-01	XSTR,MFET,240,N,200V,20A,TO247,Q7,8
62	2	4840-0088-01	XSTR,MFET,450,N,500V,14A,T0247,Q23,31
63	1	4745-0007-01	THERMR,NTC,I LIMIT,4A,16 OHM,P,RT1
64	1	4745-0008-01	THERMR,PTC,SURF TMP,90 DEG,RT2
65	1	4815-0019-01	VARISTOR,275V,4500A,RD,VDE APD,RV1
66	1	4815-0013-01	VARISTOR,150V,6500A,RD,RV2
67	2	4711-4702-700	RES,47K,5%,1/4W,CFM,R21,22
68	19	4711-1002-700	RES,10K,5%,1/4W,CFM, R1-3,15,17,19,78,79, R81,82,90,95,97,130,132,159,170,182,183
69	2	4712-1603-700	RES,160K,5%,.5W,CFM,R4,29
70	30	4711-1001-700	RES,1K,5%,1/4W,CFM, R12,34,35,44,45,51,65, R76,73,74,77,89,91,92,98,101,111,112,122, 124,126,128,131,141,142,144,153,154,156,166
71	1	4711-4709-700	RES,47,5%,1/4W,CFM,R99
72	1	4736-0004-01	RES,0.5,1%,.4W,WW,R6
73	2	4711-4701-700	RES,4.7K,5%,1/4W,CFM,R88,157
74	6	4711-4700-700	RES,470,5%,1/4W,CFM, R20,80,109,110,172,173
75	2	4743-0010-01	RES,51K,5%,1W,MOF,R23,31
76	4	4721-2001-500	RES,2K,1%,1/4W,MF,R177,178,180,181
77	2	4721-3011-500	RES,3.01K,1%,1/4W,MF,R176,179
78	1	4721-5231-500	RES,5.23K,1%,1/4W,MF,R32
79	1	4721-4991-500	RES,4.99K,1%,1/4W,MF,R33
82	2	4711-5102-700	RES,51K,5%,1/4W,CFM,R38,39
83	1	4736-0039-01	RES,0.1,5%,5W,WW,R,5S,R40
84	5	4711-1009-700	RES,10,5%,1/4W,CFM,R42,43,64,69,72
85	2	4712-2401-700	RES,2.4K,5%,.5W,CFM,R46,52
86	3	4736-5211-01	RES,2.2K,5%,1W,WW,R47,59,60
87	2	4736-5204-01	RES,.2,1%,3W,WW,R50,41
88	1	4721-1272-500	RES,12.7K,1%,1/4W,MF,R53
89	3	4733-5390	RES,39,5%,1W,WW,R54,57,58
90	2	4733-5471	RES,470,5%,1W,WW,R55,56
91	3	4736-0046-01	RES,20,5%,5W,W,AX,>38M LL,R61-63
92	9	4711-2201-700	RES,2.2K,5%,1/4W,CFM
93	7	4711-1000-700	RES,100,5%,1/4W,CFM, R67,94,113,123,125,127,129
94	1	4711-2002-700	RES,20K,5%,1/4W,CFM,R100
95	1	4711-2200-700	RES,220,5%,1/4W,CFM,R158
96	4	4721-1211-500	RES,1.21K,1%,1/4W,MF,R137-140
97	4	4701-0000-000	RES,0,1/4W SIZE,STL SLG TYPE,R171
98	28	2108-0021-01	TEST PT,JMPR,.100 C,TP2-4,6,11,13-18,21,22,25-27,30-34,39-42,45-47
100	1	5604-0088-01	XFR,CURR SNS,200:1,100K,35A,PC,T2
101	1	5604-0091-01	XFR,GATE/BASE DR,1:1.5:1.5,PC,T3
102	1	5604-0164-01	XFR,ULTRA PT,58KHXMTR,VRT PC,T4
103	2	5604-0126-01	XFR,GATE DRV,1:1,330UH,PC,T5,6
104	2	5604-0163-01	XFR,GATE DRV,1:1:1,330UH,PC,T7,8
105	1	3130-0197-01	IC,AMP,833,OP,DL,AUD,D08 ,U13
106	1	3130-0262-01	IC,REF,431A,V,1%,2.5-36V,TO9,U7

107	1	3130-0141-12	IC,REGL,78M12,V,12V,P,TO220P,U3
108	1	3130-0471-01	IC,OPT-C,4502,19%C,HI-SP,D08,U4
110	1	3130-0142-12	IC,REGL,79M12,V,12V,NEG,TO220,U8
111	1	3130-0440-01	IC,MODR,3525A,PUSE WIDTH,D16,U9
112	1	3130-0318-01	IC,INV,HC14,HX,SCHMIT-TRG,D14,U10
113	1	3130-0393	IC,CMPRTR,393A,V,DL,D08 SSI*, U11
114	1	3130-0511-01	IC,GATE,HCT08,QD,2-INP,AND,D14,U12
115	1	5604-0172-01	XFR,P,5V,(2)15V,115/230V,PC,T1
117	2	5110-0018-01	FUS CLIP,6.3A,500V,5M,PC
119	3	2900-0029-01	HSNK,TO220,.37X.9X.7FIN,CLP-ON
120	12	2109-0062-01	SHUNT,P,.2C,.040D,2P,AU
121	6	2109-0170-01	SHUNT,.1C,.025,2P,AU,J2-7
123	1	5801-1081-120	SCR,M,M3X16,PHP,S304,P,7985
124	2	5801-1231-140	SCR,M,M3X42,PHP,NY,P,7985
125	2	5820-0200-040	NUT,HX,M3,NY,P,934
126	1	5875-2012-030	SPCR,R,6X3,3.2ID,AL,P
128	1	0500-7345-01	COVER HPA U*P
129	1	0500-7344-01	SHEILD,HPA U*P
130	1	0500-7416-01	SHEILD,BOTTOM HPA
131	1	0500-7419-01	INSULATOR,HPA
132	8	5801-1041-111	SCR,M,M3X6,PHP,ST,Z,7985
133	2	5801-1061-120	SCR,M,M3X10,PHP,S304,P,7985
135	9	5826-0200-011	NUT,LCK,M3,ST,Z,985
137	1	2886-0003	P,HLE,BR,N,1.00DIA
138	1	2402-0459-01	LABEL,VOLTAGE WARNING
139	8	2870-0018-01	NUT,SPD,U-TYP,ST,Z,"2062,N-SCR
140	1	3502-0020-01	FAN,52X10,9.2CFM,12V
141	1	1536-2258	CAP,2.2UF,50V,20%,LL,RD,C44
142	1	0500-7996-01	PLATE,DRIP U*P FAN
143	4	5887-1122-030	STDF,HX,MF,M3X19,WF6,AL,P
150	1	1540-0110-01	CAP,2200UF,16V,20%,AL,RD ,C20
152	1	2104-0078-01	SKT,S,3P,.2C,.04,COLL,.18INSN,JW12
153	3	1800-0017	IND,330UH,10%,110M,MLD,SHLD,L1,8,9
154	1	1507-0012-01	CAP,.047UF,50V,20%,AX,Z5U,C9
155	1	2402-1286-01	LABEL,FACTORY PRESET,120VAC
156	2	4743-0016-01	RES,150,5%,3W,MIN.,MOF,R160,162
157	2	4743-0017-01	RES,100,5%,2W,MOF,MINIATURE,R161,163

0301-0810-01 PCB ASSY,U*P ALARM D0

Item	Qty	Part Number	Description
1	1	1700-1071-01	PCB,U*P ALARM
2	1	4820-0012	LED,GN,2.8V,20M,3 M,T1-3/4,CR1
3	2	4800-0010	DIO,RC,4003,200V,1A,AX,CR2,CR19
4	2	4800-0038-01	DIO,GP,4148,1V,10M,AX,CR3,CR4
5	14	4820-0060-01	LED,RD,20M,1.6KM,T1-3/4,28M LD,CR5-18
6	2	1540-0095-01	CAP,47UF,16V,20%,AL,RD,C1,5
7	8	1508-0033-01	CAP,.1UF,50V,20%,Z5U,R,.1S,T/R,C2,3,8-13
8	1	1510-0146-01	CAP,.01UF,100V,2%,PP,RD,C4
9	2	1537-0006-01	CAP,.1F,5.5V,DBL LAYER,C6,7
10	1	1510-0093-01	CAP,.47UF,63V,5%,MPET,BX ,C14
11	1	2109-0170-01	SHUNT,.1C,.025,2P,AU
12	1	6003-0092-01	CBL/A,FLX,12C,330.2L,J1
13	2	2200-0040-01	XDCR,PZ,3KH,30VP-P,80DB,R/A,PC,LS1,2
14	1	4830-0087-01	XSTR,NPN,2222A,40V,500M,TO92,Q1
15	1	4840-0100-01	XSTR,MFET,N,50V,1.7A,TO250,Q2
16	2	4715-0010-01	RESN,10K,2%,1/8W,BUS,S10 ,RN1,2
17	8	4711-6200-700	RES,620,5%,1/4W,CFM,R1,18-24
18	2	4711-4702-700	RES,47K,5%,1/4W,CFM,R2,27
19	1	4711-4709-700	RES,47,5%,1/4W,CFM,R3
20	2	4711-1002-700	RES,10K,5%,1/4W,CFM,R9,10
21	1	4721-6341-500	RES,6.34K,1%,1/4W,MF,R6
22	1	4751-0034	POT,10K,10%,.15W,S/T,PC,V-A,R8
23	7	4711-3909-700	RES,39,5%,1/4W,CFM,R11-R17
24	1	4711-2203-700	RES,220K,5%,1/4W,CFM,R25
25	1	4711-7501-700	RES,7.5K,5%,1/4W,CFM,R26
26	1	5101-0015-01	SW,PB,MOM,SPST,50M,12V,PC,S1
28	2	3130-0031-01	IC,AMP,358,OP,DL,D08,U1,2
29	1	3130-0549-01	IC,REG,595,SHIFT,8B,SER IN,D14,U3
30	1	3130-5013-01	IC,MVB,HC4538,MONO,RETRG,D16,U4
31	1	3130-5021-01	IC,GATE,HC08,QD,2-IN,AND,D14,U5
32	1	0701-2376-0100	GAL,PROGRAMED,U*P,ALM LED CONTRL,U6
33	1	3130-0095-01	IC,INV,HC04,HX,D14,U7
34	1	3130-3001	IC,ARR,2003,XSTR,DARN,DRV,D16,U8
35	1	0500-7259-01	SUPPORT,LED-ULTRAPOST
36	1	2104-0035-01	CON,HDR,2.54C,2P,5.97L,AU,JW1
37	1	1508-0160-01	CAP,.22uF,50V,20%,Z5U,R,.1S,C15
38	.01	1600-0178-01	ADH,CYANCRYL,SUPERBNDR 495
39	2	4721-1002-500	RES,10K,1%,1/4W,MF,R4,5
40	1	4721-1001-500	RES,1K,1%,1/4W,MF,R7
41	2	4721-1211-500	RES,1.21K,1%,1/4W,MF,R28,29
42	.083	1600-0113-01	ADH,HOT MLT,STICK,CLR,.45X12"

0301-0812-01 PCB,U*P CAP TUNER,EUROPEAN B0

Item	Qty	Part Number	Description
1	1	1700-1074-01	PCB,U*P CAP TUNER,EUROPEAN SSI
2	2	1510-0192-01	CAP,.022UF,1KVDC/400VAC,PP,BOX,22.5, C1,C7
3	2	1510-0186-01	CAP,.01UF,1250V,5%,PP,BOX,22.5MMLS, C2,C8
4	2	1510-0194-01	CAP,.0033UF,1KV,10%,PP,BOX,15MMLS, C3,C9
5	2	1510-0187-01	CAP,1000PF,1250V,10%,PP,BOX,15MMLS, C4,C10
6	2	1510-0199-01	CAP,2200PF,1KV,10%,PP,BOX,15MMLS, C5,C11
7	2	1510-0190-01	CAP,4700PF,1250V,5%,PP,BOX,15MMLS, C6,C12
8	8	2104-0036-12	SOCKET,STRIP,.040,FEMALE,1X2POS,.2C, JW1-JW8
10	4	2109-0252-12	CONN,HDR,LKG,.156CTR,12POS,TIN/BR, P2-P5
11	3	2103-0029	TERM,Q/D,.250X.032,TAB,PCMT,TIN/BR, P1,P6,P8
12	1	2109-0252-04	CONN,HDR,LKG,.156CTR,4POS,TIN/BR,P10
13	8	2109-0062-01	SHUNT,PLUG,.200CTR,.040DIA,2POS,AU/
14	1	2101-0045-05	TERM BLK,TUBLR,5MMCTR,26-14AWG,10A,J1

0301-0816-01 PCB, U*P CAP TUNER,NON-EUROPEAN C0

Item	Qty	Part Number	Description
1	1	1700-1079-01	PCB ASSY,U*P CAP TUNER,NON-EUROPEAN
2	4	1510-0322-01	CAP,.068UF,1300VDC/500VAC,5%,PP,RAD, C1,2,9,10
3	8	1510-0190-01	CAP,4700PF,1250V,5%,PP,BOX,15MMLS, C3,4,11,12,17-20
4	4	1510-0199-01	CAP,2200PF,1KV,10%,PP,BOX,15MMLS, C5,6,13,14
5	4	1510-0186-01	CAP,.01UF,1250V,5%,PP,BOX,22.5MMLS, C7,8,15,16
6	10	2104-0036-12	SOCKET,STRIP,.040,FEMALE,1X2POS,.2C, JW2-11
7	1	2101-0045-05	TERM BLK,TUBLR,5MMCTR,26-14AWG,10A,J1
8	3	2103-0029	TERM,Q/D,.250X.032,TAB,PCMT,TIN/BR,P1,7,8
9	4	2109-0252-12	CONN,HDR,LKG,.156CTR,12POS,TIN/BR,P2-5
10	1	2109-0252-04	CONN,HDR,LKG,.156CTR,4POS,TIN/BR,P10
11	10	2109-0062-01	SHUNT,PLUG,.200CTR,.040DIA,2POS,AU/

0351-0547-01 PWR CRD,USA TO IEC 320,18/3,125V A0

Item	Qty	Part Number	Description
1	1	6003-0007	POWER CORD,18/3,125V,10A,7FT 6IN,US
2	1	0649-0006-22	BAG,PLASTIC
3	1	2450-0008-01	LABEL,BLANK,PAPER,THERMAL,88.9X76.2

0351-0547-02 PWR CRD,SCHUKO TO IEC 320,1MM SQ A0

Item	Qty	Part Number	Description
1	1	6003-0033-01	POWER CORD,1MM SQ,250V,10A,2.5M,SCH
2	1	0649-0006-22	BAG,PLASTIC
3	1	2450-0008-01	LABEL,BLANK,PAPER,THERMAL,88.9X76.2

0351-0547-03 PWR CRD,UK TO IEC 320,1MM SQ,250 A0

Item	Qty	Part Number	Description
1	1	6003-0040-01	POWER CORD,1MM SQ,250V,10A,2.5M,U.K
2	1	0649-0006-22	BAG,PLASTIC
3	1	2450-0008-01	LABEL,BLANK,PAPER,THERMAL,88.9X76.2

0351-0547-04 PWR CRD,JAPAN TO IEC 320,2MM SQ, A0

Item	Qty	Part Number	Description
1	1	6003-0035-01	POWER CORD,2MM SQ,125V,15A,2M,JAPAN
2	1	0649-0006-22	BAG,PLASTIC
3	1	2450-0008-01	LABEL,BLANK,PAPER,THERMAL,88.9X76.2

0351-0547-05 US,INSTALL KIT,7585,W/FILTER A0

Item	Qty	Part Number	Description
1	1	2700-0017-01	FILTER,LINE,6A,125V,PLUG-IN
2	1	0649-0006-22	BAG,PLASTIC
3	1	2450-0008-01	LABEL,BLANK,PAPER,THERMAL,88.9X76.2

0351-0547-06 PWR CRD,U*P HARDWIRE, IEC320 TO A0

Item	Qty	Part Number	Description
1	1	6003-0094-01	POWER CORD,18/3,250V,10A,.5M,IEC320
2	1	0649-0006-22	BAG,PLASTIC
3	1	2450-0008-01	LABEL,BLANK,PAPER,THERMAL,88.9X76.2

0351-1131-02 INSTALL KIT U*P,NON-EUROPEAN B0

Item	Qty	Part Number	Description
3	4	2880-8919-01	BOLT,TAPER,HXHD,ZN,P,3/8X3.00L
4	4	6009-0005	CABLE TIE,NYLON,7-1/2 INCH
6	1	0649-0006-02	BAG PLASTIC 4 X 6 1/2 4MIL THK
7	1	2450-0008-01	LABEL,BLANK,PAPER,THERMAL,88.9X76.2
9	4	5840-0900-011	WSH,FL STD,M10,ST,Z,125A

0351-1302-01 INSTL KIT,U*P FERRITE RCVR ANTENN A0

Item	Qty	Part Number	Description
1	2	0300-1782-01	ASSY ANT,U*P FERRITE ANTENNA
2	1	0650-1984-01	CABLE ASSY,SLAVE U*P FERRITE ANTENN
3	1	0650-1985-01	CABLE ASSY,U*P FERRITE RCVR ANTENNA
4	1	0650-1986-01	CABLE ASSY,U*P FERRITE RCVR ANTENNA
5	2	2109-0236-32	CONN,HSG,PLUG,.165CTR,.045,W/O EARS
6	8	2109-0236-05	CONTACT,PIN,CRIMP,24-18AWG,TIN/PHBR
7	.098	3120-0005	TUBING,TEFLON,.049ID,.012WALL,18AWG
8	1	0649-1604-01	PKG ASSY,U*P FERRITE RCVR ANTENNA
9	.082	3121-0008	TUBING,HEAT SHRINK,.375ID
10	1	2103-0141-01	TERM,Q/D,.250X.032,TAB,INS,22-18AWG
11	1	8000-1718-01	INSTALL INSTRS,U*POST FERRITE ANTEN
12	1	1600-0033	PREP PAD,ALCOHOL,STERILE,SMALL
13	1	0351-1304-02	INSTALL KIT,U*P FLASH UP GRADE KIT
14	1	0649-0006-04	BAG PLASTIC 8 X 104 MIL THK

0351-1304-01 INST KIT,U*P FLASH UPGD KIT B0

Item	Qty	Part Number	Description
1	1	0701-2377-0210	EPROM,PROGRAMMED,U*P APLLICATION CO
2	1	8000-1728-01	U*P FLASH UPGRADE INSTR
3	1	0649-0006-04	BAG PLASTIC 8 X 104 MIL THK
4	.0005	0649-0548-01	BUBBLE WRAP,ANTI-STATIC,48"W
5	1	0649-1081-01	BOX,TUCK-FOLDER,150 X 90 X 57
6	1	3200-0228-04	TAPE,PP,SSP,RB,.0016T2"W1K YD
7	.5	2450-0008-01	LBL,BLNK,PAP,THERM,89X76M,RL
8	1	1400-0141-01	TOOL,EXTRACTION,PLC

0351-1305-01 INSTALL KIT,U*P SYNC CBL A0

Item	Qty	Part Number	Description
1	1	0650-1989-01	CABLE ASSY,U*P SYNC CABLE
2	2	6009-0004	MOUNT,ADHESIVE BACK,3/4X3/4
3	2	6009-0002	CABLE TIE,NYLON,3"NOM
4	6	2109-0165-01	CONTACT,SOCKET,.025SQ,26-22AWG,HI-P
5	2	0351-1304-02	INSTALL KIT,U*P FLASH UP GRADE KIT
6	1	8000-1731-01	INSTALL INTRS,U*POST WIRED SYNCHRON
7	1	2109-0406-06	CONN,HSG,RCPT,.100CTR,.025SQ,2X3POS
8	6	2109-0165-01	CONTACT,SOCKET,.025SQ,26-22AWG,HI-P
9	.164	3121-0008	TUBING,HEAT SHRINK,.375ID
10	1	0649-0006-02	BAG PLASTIC 4 X 6 1/2 4MIL THK
11	1	2450-0008-01	LABEL,BLANK,PAPER,THERMAL,88.9X76.2
13	.0005	0649-0548-01	BUBBLE WRAP,ANTI-STATIC,48"W
14	2	1800-0199-01	BEAD,FERRITE,13LX23DIAX12.9ID
15	2	2700-0039-06	FILTER,EMI,FERRITE,RIBBON,METAL CLI
16	1	0649-0006-25	BAGS,PLASTIC
17	1	0649-0006-28	BAGS,PLASTIC

Drawings

Drawings are listed in part number order for easy reference. Drawings with a letter prefix S are schematics.

0301-0784-01 LPA Transmitter Board

0301-0785-01 Receiver/Controller Board

0301-0791-01 Switched Mode Tx Board

0301-0810-01 Alarm Board

0301-0812-01 Cap Tuner Board, European

0301-0816-01 Cap Tuner Board, Non-European