MANUFACTURING PROGRAMMING AND TEST PROCEDURE

PTDR Controller Module

Rev 1.0 – January 16 2006

Document Number: 931-000080-000
Project Number: 2005-10

Revisions

Revision	Date	Changed by	Description
1.00	Jan 16, 2006	E. Kaplounovski	First release

Glossary of Abbreviations and Acronyms

LED – light-emitting diode
DUT – device under test
ECO – engineering change order

Scope and Objectives

This document applies to the Passive Door Tag Reader Controller Module 1.0, Project 2005-10. It defines tests that should be performed on all the units leaving the production facility. This procedure applies to pilot and subsequent production runs.

This document describes all steps and procedures required to program the firmware into the DUT and perform functional testing.

This procedure is instrumental in product quality assurance. The vendor is responsible for following it precisely and implementing all required changes (as specified in the ECOs) in a timely and orderly fashion.

Reference documents:

600-000290-000 – BOM

911-000091-000 – Schematic diagram

380-000091-000 – PCB design files

1 Test Conditions and Equipment

1.1 Normal Test Conditions

All tests are to be conducted under the following conditions:

Temperature:	Normal Ambient (20^{o} to 28^{o}C)
Voltage:	24.0 Volt +/- 1.0 Volt

Functional testing of this device involves generating and receiving LF signals.
Therefore, to facilitate successful testing, the following measures are important:

- The DUT's antenna should be located at least 1m away from any electronic or electrical device. This includes computers, monitors, power adapters, oscilloscopes, etc.
- The test area should be clear of all electrical equipment not directly involved in testing.

1.2 Recommended Test Equipment

Standard equipment:
Equivalent test equipment may be substituted

DC Power supply for DUT	GPS-3030D
Digital multi-meter	Wavetek 23XT
Personal computer (Windows 2000, XP)	1
USB-RS485 serial adapter capable of 230400bps	1
Oscilloscope	TEK TDS3054
Atmel serial programmer	AVRISP

The vendor is expected to procure the standard equipment.

Non-standard test equipment

The non-standard test equipment consists of:

- Serial cable with two DB-9 connectors (M and F);
- 2-conductor power cable (1m) for connecting the DUT to power supply;
- SPST toggle switch with two flying leads for emulating the door switch contact;
- Verichip passive implantable tag;
- Verichip PTDR Panel Antenna.

2 Test Setup and Configuration

2.1 Test setup preparationi

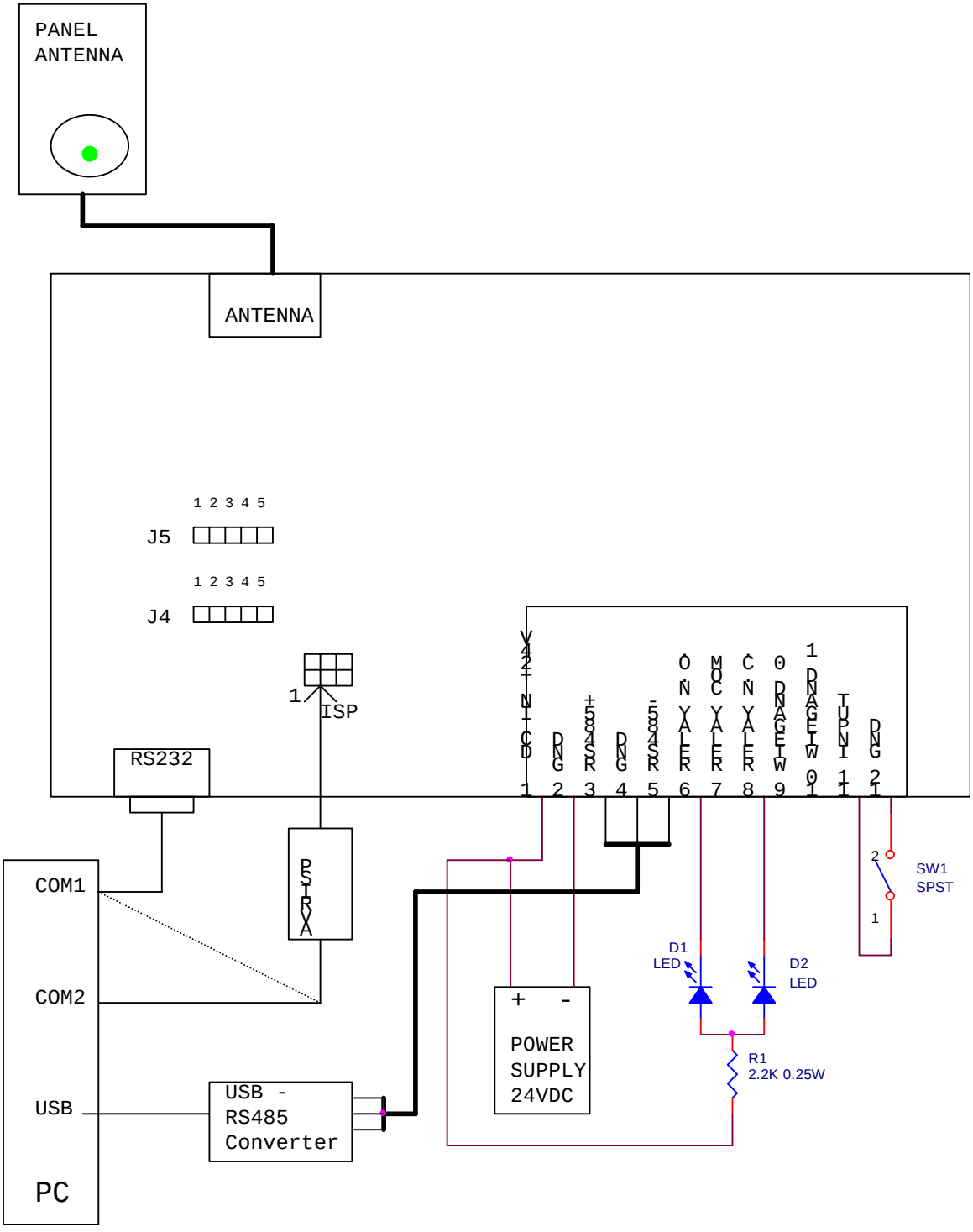

FIG 2.1: TEST SET UP

Set the laboratory power supply to 24VDC output. Set the current overload limit to 800mA.

If the PC has two serial ports, Atmel AVR ISP adapter and serial cable used for testing the DUT's RS232 connection can be connected to the PC simultaneously. If the PC has only one serial port, it has to be shared between these two tasks and only one application can control the port at one time.

2.2 Software installation and configuration

The software package required to program the DUT consists of the following:

- Driver for the AVRISP (stk500.exe);
- Main firmware loader batch file (PTDR.bat)
- Main firmware code (eac_ptdr.hex and eac_ptdr.eep)
- Serial number setting utility for Windows: SerialNumProgramUtility.exe. This program does not require setup; just double-click on the file name in Windows Explorer to launch.

Copy all these files into a single folder. Creating shortcuts to the batch and executable files for more convenient access is recommended.

3 Initial DC test

Connect the DUT to power supply. Turn the power supply on. Verify that the power supply is not overloaded and the current draw does not exceed 200mA.

Measure the voltage between test points TP1 (GND) and TP2 (+5V). Verify that it is within 4.75 – 5.25VDC.

Turn off the power supply.

4 FLASH Programming

Connect the 6-pin ISP header from the AVRISP module to the DUT observing polarity. The coloured conductor in the ribbon cable should face pin number 1 of the ISP header on the DUT.

Turn the power supply on. The LED on the AVRISP module should cycle from red through yellow to green, finally settling on green. This means the AVRISP is connected correctly to the DUT. If this is not the case, turn the power supply off immediately and rectify the problem. Note: AVRISP may be damaged even by a single wrong connection.

Setup the programming parameters (fuse setting) as below if Avrstudio4.12 software is used:

User must input hex file and eprom file
BootFlash = 1024
Boot Reset vector = Enabled
Brownout detection = 4.3v
Ext full swing crystal 16ck/14ck = 65ms

All these must be check and the final checksum would be 0xF8, DCF7

Run the PTDR.bat file. An MS-DOS window will pop up informing you about the programming process progress. The system will erase the device, program the FLASH memory and fuse bits.

Close the console window and turn off the power supply.

Disconnect the ATAVRISP cable from the DUT.

5 Functional Test

5.1 LF Exciter and Receiver

The DUT contains circuitry for generating the 134.2 kHz square wave signal. When this signal is applied to the PTDR Panel Antenna, it creates magnetic field that energizes the passive tag. The antenna is a tuned circuit that converts the square excitation signal into mostly sinusoidal current waveform. Each antenna is individually tuned by a set of fixed capacitors. The two DC-blocking capacitors in the PTDR Controller Module are the part of resonant circuit as well, but since their impedance is much lower than other impedances in the tank, influence of their tolerances on the tank tuning is negligible. Therefore, the Panel Antenna can be tuned independently of the Controller Module; and different Controller Modules and Panel Antennas are fully interchangeable.

The field generator is powered from a separate linear regulator built around U4. To verify its correct operation, measure the voltage between test points TP1 (GND) and TP3 (VTX). It should be within 13.3 -16.3VDC limits. Total DC current draw with the antenna connected and driven should increase to about 250-500mA. A value below 250mA is indicative of poorly tuned antenna – refer to its adjustment procedure 931-000081-000 and re-align if required. A value exceeding 500mA may indicate a problem with the Controller board – investigate and fix before proceeding.

When the controller detects a tag, a number of events take place. These events facilitate testing of the correct operation of many various parts of the controller. Perform the following checks:

When the DUT is powered up, the green LED on the Controller should start slowly flashing. The green LED on the Panel Antenna should be steadily and dimly lit.

Make sure the DUT's RS232 port is connected to the PC's COM port. Open a HyperTerminal session with the following settings: Baud rate 19200, communication settings 8-N-1.

Hold the test tag with its axis parallel to the centre line of the antenna and approximately in the centre of the antenna. Slowly bringing the tag closer to the antenna, note the moment when the tag is detected. At this time the beeper located in the antenna should produce a single beep, and the green LED on the antenna should flash brightly. The green LED will continue flashing as long as the tag is in the detection zone, but the beeper will sound only once. At the same time of initial detection the tag serial number is sent to the RS232 port.

The tag should be detected at a minimum distance of 3.5" from the surface of the antenna in the most favourable location and orientation. Flashing LED on the antenna helps in finding out the most sensitive area and the best tag orientation.

In order to repeat the beep and RS232 message the tag must be removed from the field for at least 5 seconds and then brought back.

If you are using the same COM port on the PC for both RS232 connection to the DUT and ISP, disconnect the HyperTerminal program. Otherwise the attempt at programming the next device through ISP will fail – these two programs cannot use the same COM port simultaneously.

5.2 Serial Number Programming

This step requires having a high speed (230400bps) RS485 connection to the PC and running a special test utility. Make sure the DUT is connected to the RS485 converter and apply power.

Launch the serial number setting utility on the PC. Click 'Next' button.

In the next window, select the proper COM Port where your USB converter is connected.

Select the proper device type: 'Other'. Set the Baud rate to 230400bps.

Enter the desired serial number in the text box of the utility. The serial number should match that on the label attached to the DUT.

Click the 'Set Serial #' button beside the text box, and the 'Next' button at the bottom of the window.

The utility will try to program the device. The next screen will show what serial number has just been programmed. If it matches the label, click the 'Finish' button to quit the application.

5.3 Door Switch and Relay

Under certain conditions, the DUT will activate its relay when the tag is detected and the door switch contact is closed.
To test this feature, set the option select jumpers in the following positions:

- J5 (upper) – to the rightmost position, i.e. shorting pins 4 and 5;
- J4 (lower) – shorting pins 2 and 3.

Close the toggle switch that emulates door contact. Bring the tag into the field and verify that the relay becomes energized – the LEDs on the test fixture should change their states.
In about 10 seconds the relay should de-energize, and the test fixture LEDs return to their original state.

5.4 Wiegand Output

Wiegand output is produced every time a new tag is detected, in the same way as the RS232 output. The signalling scheme consists of two separate lines for transmitting logic ones and zeros. In their idle state, both signal lines are pulled to high logic level (+5V). To signal one or zero, one of the lines pulses down to logic zero level (0V) for about 80us in this particular implementation.
Connect the scope to one of the Wiegand outputs (pin 9 or 10 on the main connector).
Set the scope for Normal triggering mode on the falling edge.
Bring the tag into the detection field. When it is first detected, there should be a sequence of short negative pulses (from 5V to GND) on the line.
Repeat the test with the other Wiegand line. The tag must be removed from the field for more than 5 seconds to be re-acquired and produce another Wiegand message.
If you use a dual-channel scope, both Wiegand lines can be tested at once. This method has an extra benefit: according to the Wiegand standard, the two signal lines cannot go low at the same time. Observing them at once can verify that.

5.5 Option Jumpers

Option jumpers J4 and J5 select different modes of operation by varying DC voltages produced by resistive dividers and applied to the microcontroller's ADC inputs. The microcontroller measures these voltages, compares them with some pre-defined ranges, and enters corresponding operation mode.
Since not all possible jumper settings are utilized by current firmware (but there is a possibility of its update in the field), it is necessary to verify the correct operation of these selectors by measuring the voltage produced at various jumper settings.
The most convenient points for checking the voltage are pins 1 or 4 on each header (J4 and J5). These two pins are electrically connected, so measuring the voltage on either pin will produce the same result. Since the jumper will sometimes occupy one of those pins, it is convenient to switch between them as needed.

The measurements are performed with the DMM and referenced to the system ground. Measured voltages should fall within following limits:

Jumper position	1-2	2-3	3-4	4-5
ADC voltage	4.75 – 5.25	1.20 – 1.48	2.36 – 2.90	<0.2

Measure the voltage for both ADC channels (J4 and J5), moving the jumpers through all positions indicated in the table.
When finished, install the jumpers as follows:
JP4: 2-3;
JP5: 4-5.

6 Conclusion

Disconnect the DUT from the test setup.

The PTDR Controller Module is now ready for the next technological step as required by the Manufacturing Assembly Instructions.