TECHNICAL MANUAL

IDI 6005
Speed Sign Controller

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1. Revision History

Revision Number	***Details***	***Date***
1.0	Initial Version	5Sep2007
1.1	Updated Controller Firmware Update Procedure	25Sep2007
1.2	Corrected RS-232 pinout; added photocell wire colors	28Sep2007

2. Overview

The IDI 6005 Speed Sign Controller has been designed as a low-cost controller capable of receiving radar data from a serial port and displaying information to standard LED boards via Thin protocol.

The 6005 includes the following features:

- Single processor
- Three status LEDs
- One RS-232 serial port – receive only
- One RS-485 serial port – transmit only
- Six general purpose digital inputs
- Four thumbwheel switch inputs
- Six thumbwheel switch selection outputs
- One photocell input
- One output

3. Operation

Refer to Section 4, Technical Details, for information on how to connect the unit to power, the radar sensor, LED boards, and strobes. This section defines how the Speed Sign Controller operates.

3.1. Power

Upon applying power to the Speed Sign Controller, the Heartbeat and Lamp LEDs will begin flashing. The Radar LED will flash if information is received from the Radar Sensor. Before beginning normal operations, the controller will display three diagnostic messages on the LED boards, to allow the operator to verify that they are working properly. The messages are: All LEDs on, All LEDs off, and the numbers 123 (12 if in MPH mode).

3.2. Configuration

The LED board configuration must be set on the Digital Inputs to provide for proper sign display.

3.3. Variable Speed Limit Sign Mode

When Digital Input 4 is not grounded, the sign is in Variable Speed Limit Mode. The sign will display the speeds on either Bank 1 or Bank 2 of the Thumbwheel Switches. If Digital Input 5 is open, then Speed 2 will be displayed. If Digital Input 5 is grounded, then Speed 1 will be displayed.

3.4. Radar Mode

When Digital Input 4 is grounded, the sign is in Radar Mode. The sign will remain blank if no information is received from the radar gun, or if the speed is 5 MPH or less. If the speed is greater than 5 MPH but less than the value entered on the SPEED 1 thumbwheel switches, the speed will be displayed on the sign for three seconds. If the speed is above the value entered on the SPEED 1 thumbwheel switches, but less than the value entered on the SPEED 2 thumbwheel switches, then the

speed will flash on the sign for three seconds. If the speed equals or exceeds the value on the SPEED 2 thumbwheel switches, the sign will blank and the overspeed output will be enabled.

4. Technical Details

Refer to **IDI 6005 Controller - Parts Locations** at the end of this document for a pictorial representation of the locations of the controller parts referenced in the following sections.

4.1. Power

The 6005 board receives power through J1. The board accepts 9-30 volts, either AC or DC. To properly power the radar gun on J4, this input voltage should be between 11.5 and 15VDC. Jumper JMP1/JP1, located near J1, should have the jumper set to the proper position based on whether AC or DC is being applied to J1. Pin 1 (square solder pad on bottom of board) is AC Neutral or DC negative. Pin 2 is AC live or DC positive. The board draws no more than 0.5 amp.

4.2. LEDs

The board has three LEDs used for status, labeled D8, D9 and D10. D8 is the Processor Heartbeat LED, and will blink at a steady rate whenever the Processor is operating properly. D9 is the Radar LED and will flash whenever data is received from the radar sensor. D10 is the Lamp LED, and indicates when data is being sent to the LED boards.

4.3. Serial Communications

Refer to **IDI 6005 Controller – Cable Connector Details** at the end of this document for details of the connector pinouts.

The 6005 controller supports one RS-232 serial receive port, and one RS-485 transmit port. The table below indicates the names for the ports, the connectors that each port is associated with, and the jumpers used to terminate the RS-485, if necessary.

Connector	Type	Function	RS-485 Terminators
J4	RS-232	Radar input	n/a
J5	RS-485	LED board interface	JMP1, 2

The RS-232 connector J4 is a DB9 female connector. The pinout is as follows:

Pin	Signal Name	Signal Description
1	Gnd	Signal Ground
2	-	
3	-	
4	RXD	Receive Data
5	Power	Nom. +12VDC
6	Ch. Gnd	Chassis Ground

7	-	
8	-	
9	Gnd	Signal Ground

The RS-485 connector (J5) supports two-wire transmit data. The pinout for the port is as shown in the following table. Pin 1 can be identified from the bottom of the board by its square solder pad.

Pin	Signal Name	Signal Description
1	TX+	Transmit Positive
2	TX-	Transmit Negative
3	DIGOUT_0	Digital Output
4	PHOTOCELL	Photocell Input
5	+5VDC	+5VDC
6	GND	Signal Ground

The RS-485 port supports communications to LED boards using Thin protocol at 38400 baud, with 8 data bits, no parity and 1 stop bit.

4.4. Digital Inputs

The IDI 6005 supports six general-purpose digital inputs, routed to the controller via connector J6. The inputs are on pins 1 through 6, with pin 7 being signal ground, and pin 8 being +5VDC routed through a 100 ohm resistor (R9). The inputs are rated for voltages from 0 to +5VDC. They are normally pulled up to 5VDC using active inputs internal to the microprocessor.

4.5. Digital Output

The 6005 supports one digital output, routed from the controller via connector J5. The output is on pin 3, with pin 6 being signal ground, and pin 5 being +5VDC routed through a 100 ohm resistor (R8). The output is open-source, low-true, and is rated for 100mA. J5 pin 6 should be connected to the ground of the device being switched to prevent excess current from being conducted across the traces of the controller.

4.6. Thumbwheel Switch Interface

The 6005 supports the ability to interface to up to six digits of thumbwheel switches, using two different interfaces. The first interface, through J7, requires that steering diodes be installed on the thumbwheel switches themselves, with the benefit that only 10 wires are required to connect to the switch assemblies. The second interface, through J8, allows the steering diodes to be installed on the controller board (D17-D40), but requires 30 connections to the thumbwheel switches. In either case, the controller has the ability to monitor six digits, each of which can be set to the values from 0 to 9. The six digits are normally organized into two banks of three digits each, as indicated by the names applied to the select lines – bank 1 can be used to set a SPEED limit, while bank two can be used to set a BLANKing threshold.

J7 – Steering Diodes installed on Thumbwheel Switches

Pin	Signal Name	Signal Description
1	TWSIN1	Value, bit 0
2	TWSIN2	Value, bit 1
3	TWSIN4	Value, bit 2
4	TWSIN8	Value, bit 3
5	SPDHUNSEL	Speed, Hundreds Digit Select Line
6	SPDTENSEL	Speed, Tens Digit Select Line
7	SPDONSEL	Speed, Ones Digit Select Line
8	BLANKHUNSEL	Blank, Hundreds Digit Select Line
9	BLANKTENSEL	Blank, Tens Digit Select Line
10	BLANKONESEL	Blank, Ones Digit Select Line

J8 – Steering Diodes installed on Controller (D17-D40)

Pin	Digit	Signal Description
SPEED LIMIT THRESHOLD		
1	HUNDREDS	1 – Bit 0
2		2 – Bit 1
3		4 – Bit 2
4		8 – Bit 3
5		C – Common
1	TENS	1 – Bit 0
2		2 – Bit 1
3		4 – Bit 2
4		8 – Bit 3
5		C – Common
1	ONES	1 – Bit 0
2		2 – Bit 1
3		4 – Bit 2
4		8 – Bit 3
5		C – Common
BLANKING THRESHOLD		
1	HUNDREDS	1 – Bit 0
2		2 – Bit 1
3		4 – Bit 2
4		8 – Bit 3
5		C – Common
1	TENS	1 – Bit 0
2		2 – Bit 1
3		4 – Bit 2
4		8 – Bit 3
5		C – Common
1	ONES	1 – Bit 0
2		2 – Bit 1
3		4 – Bit 2
4		8 – Bit 3
5		C – Common

4.7. Radar

The controller can be interfaced to a Decatur SI-2 radar unit to automatically monitor traffic speed. The SI-2 should be configured according to the following table. To configure the SI-2, you will need: SI-2 RS232 programming cable; SI-2 configuration software (SI2D Config v1.7.exe); 12V power supply with a power switch; and SI-2 Configuration Instructions found in the file: SI2ConfigurationInstructionsRev07_02.pdf.

Parameter	**Value**
Speed Setup	MPH
Sensitivity Value	17
Update When Speed Changes:	Max
Override Update Rate with updates...	UNCHECKED (not selected)
updates every	3 1/10 seconds.
Data Hold Time	2
Low Speed Cutoff	5
High Speed Cutoff	200
Cos Correction 1	0
Cos Correction 2	0
Report	Approach Targets
Baud Rate	9600
Direction Report	UNCHECKED (not selected)
TX String	8n1 ASCII <D>[SSS.] <CR>
Poll String	8n1 ASCII ['*P']<CR>

4.8. Photocell

The IDI 6005 Speed Sign Controller supports a photocell. When light is striking the photocell, the sign will display at 100% brightness. When the photocell is not receiving as much light, the sign will dim to 50% brightness. The light level at which the sign switches between bright and dim can be adjusted using R11. The photocell is attached to J5 as follows:

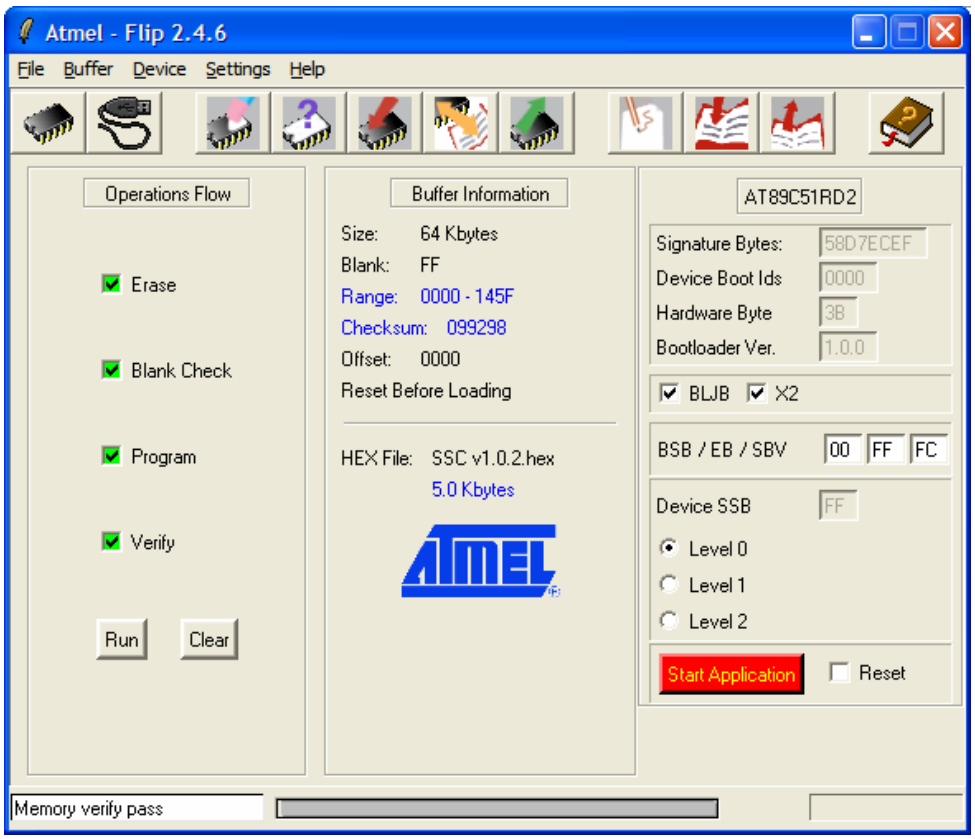
Pin	**Signal Name**	**Wire Color – Demo Unit**	**Wire Color – Production Units**
4	Photocell	White	Red
5	+5VDC	Orange	Green
6	GND	Blue	Black

White is from the white/blue pair; the white from the white/orange pair is not used.

5. Configuring the Controller

5.1. Controller Firmware Update Procedure

The Controller Firmware can be updated in the field using a custom programming cable, Atmel FLIP v2.4.6 software (available from Atmel's web site), and a computer running Windows.



1) Connect the programming cable connector to J2, ensuring that pin 1 is installed on the pin nearest J7 (square pad on bottom of board). Connect a null-modem cable from the programming cable to the serial port of an IBM-compatible computer.
2) Connect 9-30VDC power to the board, with the ground wire to pin 1 (square solder pad on the bottom of the board) and +DC to pin 2.
3) Place the FLASH switch in the ON position. Press the RESET button on the controller. This will place the controller in programming mode.
4) Start the ATMEL FLIP download utility by double-clicking the FLIP.EXE file.
5) In the upper left corner, click on the icon of the chip to Select Device. In the Device Selection box, select AT89C51RD2, then click OK.
6) Click the icon of the cable (Set Communication), then select "RS-232". In the RS-232 window, select the proper Com port and set the baud rate to 115200. Click the CONNECT button. If a window appears indicating "Timeout Error", press the RESET button on the controller again, and repeat this step.
7) In the box for AT89C51RD2 options, verify that BLJB and X2 are selected.
8) From the menu, select File->Load Hex File. Browse to the location where the file is stored, and select the file named SSC v1.0.2.hex (note that the version number may be different).

9) Under Operation Flow, verify that all operations are selected, then click the RUN button. The program will go through the operations of Erasing, Checking that the chip is Blank, Programming, and then Verifying that the program has been properly loaded.
10) Turn of the power supply to the controller, and then remove the programming cable. Turn on power to the board. Verify that the HEARTBEAT LED flashes at a rate of once per second (0.5 sec on / 0.5 sec off).
11) To quickly program another unit, run through steps 1-3. In the Set Communication window, click “Disconnect”, then “Connect”. In the box for AT89C51RD2, select X2. Continue from Step 9.

5.2. Sign Configuration

On the test unit provided, the digital inputs are controlled by a front-panel mounted DIP switch. In actual production units, it is expected that several of these switches will be replaced by jumper wires connected directly to J6. The configurations are as given in the following table:

Function	**J6 Pin**	**Open (no jumper)**	**Grounded (Jumper to J6 pin 7)**
MPH/KPH	1	KPH	MPH
VSL/Radar	4	VSL	Radar
Speed 2 / Speed 1	5	Speed 2	Speed 1

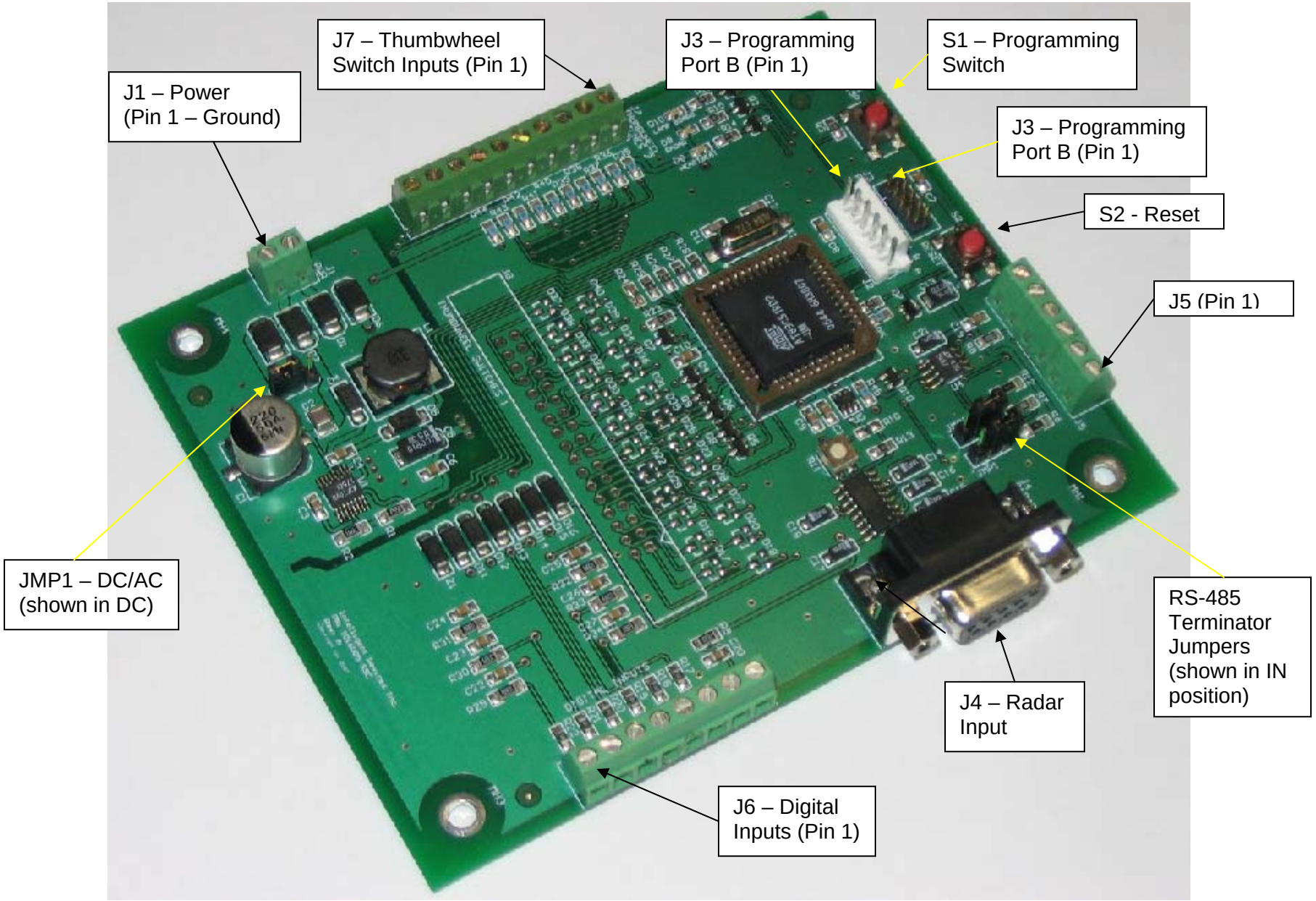
Inputs 2 and 3 are used together to determine the display configuration in conjunction with the KPH/MPH selection input.

J6 pin 1	**J6 pin 2**	**J6 pin 3**	**Configuration**
Open	Grounded	Grounded	KPH, three 7-high by 5-wide LED boards arranged in a character matrix
Open	Open	Grounded	KPH, one 8-high x14-wide LED board
Open	Grounded	Open	KPH, three 14-high x 8-wide LED boards arranged to form a 14x24 full matrix
Open	Open	Open	KPH, three 14-high x 8-wide LED boards arranged to form a 14x24 full matrix; flashing display alternates with SLOW NOW message
Grounded	Grounded	Grounded	MPH, two 7-high by 5-wide LED boards arranged in a character matrix
Grounded	Open	Grounded	MPH, one 8-high x14-wide LED board
Grounded	Grounded	Open	MPH, two 14-high x 8-wide LED boards arranged to form a 14x16 full matrix
Grounded	Open	Open	MPH, two 14-high x 8-wide LED boards arranged to form a 14x16 full matrix; flashing display alternates with SLOW NOW message

6. Specifications

6.1. Hardware

Module Size (overall, including connectors)	5.7” x 4.8” x .6” 144mm x 122mm x 18mm
Attachment	Qty 4 0.156” (4mm) holes
Operating Temperature:	-40C to +74C
Humidity	5-95% non-condensing
Power Requirements	9-30 V AC or DC
General Purpose digital I/O	6 inputs 1 output, 100 mA max.
Thumbwheel Switch Interface:	Supports six digits
Processor Speed	18.4 MHz
FLASH	64 kB
SRAM	1792 B
Serial Ports	2 total 1 – RS232 receive-only 1 – RS485 2-wire transmit only
Watchdog Supervisor	Yes
LED	3 – Heartbeat, RX, TX



IDI 6005 Speed Sign Controller - Parts Locations