SCIENTIFIC DATA SYSTEMS, INC.

## Depth Tension Line Speed Panel

# DTLS Manual

# DTLS Manual


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Section

1

# 1 DTLS Hardware

### Introduction

The Depth, Line Speed and Line Tension Panel uses three industrial process Meters to provide simultaneous digital readout of the three measurements. Meter 1 is setup in a counting mode and can accommodate virtually any encoder resolution. Meter 2 is setup in a rate \ counter indicator mode and runs from the same encoder signals as Meter 1. Meter 3 senses a 4 - 20 ma signal from a pressure transducer connected to the measure head weight indicator system. Meters for other types of line weight sensor are available.

The panel is intended to be powered by a 12 volt battery and contains a power supply providing regulated 12.0 volts and 5.0 volts for indicator and encoder power. The panel also provides 12 volts excitation for the pressure transducer. The encoder pulses are converted to depth and direction signals and routed to the depth and line speed meters and are also buffered and output to the rear panel connectors for input to the logging system. A retransmitted 4 - 20 ma signal is also available at the rear panel also for input to the logging system.

### Depth Panel Operation

Depth entries and alarm setup points are entered from the key pads of each meter. Depth1 meter contains the alarm for minimum depth. If the depth counter becomes less than this minimum, it will activate the depth alarm. Depth2/Line Speed meter contains the alarm for maximum line speed. If the line speed becomes greater than this maximum, it will activate the overspeed alarm. Depth2 meter will display both a depth and the line speed, which can be selected by pressing the DISP-key. Any of the alarms will activate an audible alarm, front panel LED, and a rear panel external connector. The audio alarm can be silenced for the duration of the cause of that

alarm by pressing the ALM DIS button. Once the alarm condition has passed, the audio alarm will be enable again for the next alarm.

To enter a new preset depth on either depth meter, press the P2-key of that meter. The last preset depth will be displayed. The key directly under each digit will change the value of that digit. After the desired changes have been made, press the E-Key to enter the value into preset depth memory. To update the depth to the preset value, press the R-key to reset the depth.

To enter new alarm values on either depth meter, press the P1-key of that meter. After changes have been made, press the E-key to enter the value into preset alarm memory. To enter a new alarm value on the line tension meter, press the PAR-key. The F1-key and F2-key can then be used to change the value. Press the PAR-key again to store the new alarm value


Fig 1.1 DTLS Face Plate


Fig 1.2  DTLS Rear Plate

Section

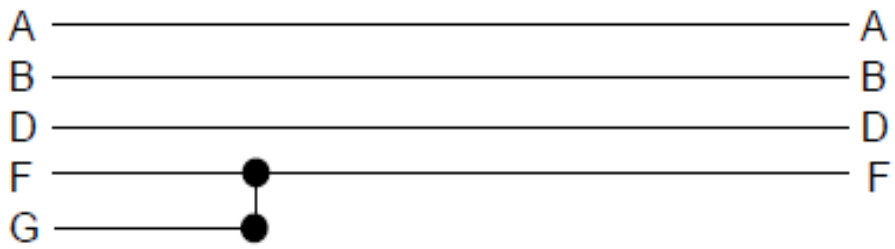
2

# 2 DTLS Connector Wiring

### Interconnection Cables

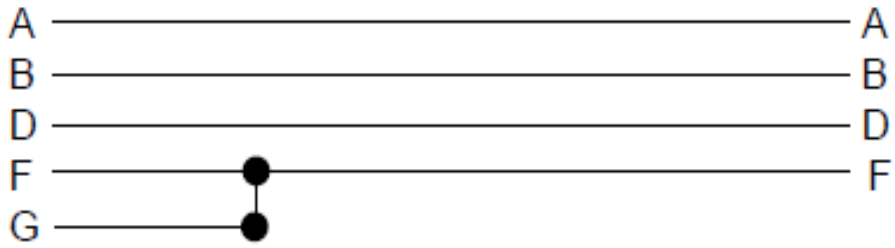
The cable to connect the depth panel buffered encoder output to the tool Interface panel has the following connections:

Depth Panel 7 Pin Female — Interface Panel 7 Pin Male




The cable to connect the depth panel encoder input to the depth encoder has The following connections:

Depth Panel 7 Pin Male — Depth Encoder 7 Pin Female



The cable for the retransmitted line tension from the depth panel to the system Tool interface panel has the following connections:

| Depth Panel 5 Pin Female | Interface Panel 5 Pin Male |
|---|---|
| C | A |
| D | B |
| E | E |

The cable for the depth panel line tension input to the pressure transducer has The following connections:

| Depth Panel 5 Pin Male | Pressure Transducer |
|---|---|
| D | 1 (Excite Usually Red) |
| B | 2 (Signal Usually Black) |
| A — Shield | 3 (Case) |
| E | |

Section

3

# 3 DTLS Meter Programing

**Setup for Depth Counter 1**

Two sets of DIP switches must be set for proper function of the Depth meter. Switch one is located on the back of the meter. Switch two is located on the right side, as viewed from the front,

(SW-1 ON Meter - 1, 4, 7, 8 ON/DOWN and 2, 3, 5, 6 OFF/UP)

(SW-2 ON Meter - 1, 2 ON/DOWN and 3, 4, 5, 6, 7, 8, 9, 10 OFF/UP)

Programming may only be accomplished by activating the `program enable' switch at the rear of the panel. Other than changing the scale factor, re-programming should only be necessary upon installation of a new meter.

| CODE | ENTRY | |
|---|---|---|
| 41 | 1 | Set unit personality to COUNTER |
| 43 | 2 | Set inputs to COUNT with UP/DOWN Control |
| 44 | 1 | Set to SINGLE EDGE COUNTING |
| 45 | 2 | Set scale multiplier to .01 |
| 46 | 2 | Set decimal point and leading zero blanking |
| 51 | -2 | Set reset mode to manual reset to preset |
| 52 | -6 | Set Output1 Alarm control to Boundry |
| 53 | 0.01 | Set Output1 Time Delay to minimum |
| 54 | 3 | Set Output2 Termination to Terminate at Reset |
| 55 | 0.01 | Set Output2 Time Delay to minimum |
| 61 | 4 | Set Right hand Dummy Zeros to None |
| 66 | 2 | Set 0perator enabled functions to Reset and Preset only |

**With the settings above**, to read out in feet (or meters)

*** Scale factor = 100 divided by encoder pulses per foot (or encoder pulses per meter)**

| JP5 Setting | 120 ppr | 400 ppr | 600 ppr | 1200 ppr |
|---|---|---|---|---|
| 1-2 No Divide | 0.8333 | 0.2500 | 0.1667 | 0.0833 |
| 3-4 /2 | 1.6667 | 0.5000 | 0.3333 | 0.1666 |
| 5-6 /4 | 3.3333 | 1.0000 | 0.6666 | 0.3333 |
| 7-8 /8 | 6.6666 | 2.0000 | 1.3333 | 0.6666 |

***Scale Factors - Note placing a "–" sign in front of scale factor reverses encoder direction.**

## Setup for Depth Counter 2/ Line Speed

Two sets of DIP switches must be set for proper function of the Depth/Line Speed meter. Switch one is located on the back of the meter. Switch two is located on the right side, as viewed from the front,

(SW-1 ON Meter - 1, 4, 7, 8 ON/DOWN and 2, 3, 5, 6 OFF/UP)

(SW-2 ON Meter – 1, 2,10 ON/DOWN and 3, 4, 5, 6, 7, 8, 9 OFF/UP)

Programming may only be accomplished by activating the `program enable' switch at the rear of the panel. Other than changing the scale factor, re-programming should only be necessary upon installation of a new meter.

| CODE | ENTRY | |
|---|---|---|
| 41 | 1 | Set unit personality to RATE METER/COUNTER |
| 42 | 3 | Set Reset for both Rate and Counter |
| 43 | 2 | Set inputs to COUNT with UP/DOWN Control |
| 44 | 1 | Set to SINGLE EDGE COUNTING |
| 45 | 2 | Set scale multiplier to .01 |
| 46 | 2 | Set counter decimal point and leading zero blanking |
| 51 | 1 | Set Output1 to Rate and Output2 to Counter |
| 52 | 6 | Set Rate Alarm control to Boundry |
| 53 | 0.01 | Set Rate Time Delay to minimum |
| 54 | 3 | Set Counter Termination to Terminate at Reset |
| 55 | 0.01 | Set Counter Time Delay to minimum |
| 56 | -2 | Set Reset Counter to Preset 2 |
| 61 | 4 | Set Right hand Dummy Zeros to None |
| 62 | 1 | Set Time Rate to 1 Second |
| 63 | 1 | Set Rate Update Time |
| 64 | 3 | Set Rate Scale Multiplier to 10 |
| 65 | 2 | Set Rate decimal point and leading zero blanking |
| 66 | 2 | Set 0perator enabled functions to Reset and Preset only |

**With the settings above**, to read out in feet per minute (or meters per minute)

*** Scale factor = 60 divided by encoder pulses per foot (or meter)**

| JP5 Setting | 120ppr | 400ppr | 600ppr | 1200ppr |
|---|---|---|---|---|
| 1-2 No Divide | 0.5000 | 0.1500 | 0.1000 | 0.0500 |
| 3-4 /2 | 1.0000 | 0.3000 | 0.2000 | 0.1000 |
| 5-6 /4 | 2.000 | 0.6000 | 0.4000 | 0.2000 |
| 7-8 /8 | 4.0000 | 1.2000 | 0.8000 | 0.4000 |

Scale factor for the Depth 2 Counter is the same as the Depth 1 Counter above.

## Setup of Line Tension

Programming may only be accomplished by activating the `program Enable' switch at the rear of the panel. Press the PAR (Parameters) key to enter Program mode and select parameter groups. Use the F1 and F2 keys to change Selections

Set each of the program groups as follows

**1-INP** Input Parameters

| Display | Parameter | Setting |
|---|---|---|
| rAn6E | Input Range – 20MA | 0.02A |
| dECPt | Display Resolution – Full Lbs. | 0 |
| round | Display Rounding Increment | 1 |
| FILtr | Filter Setting | 2.0 |
| bAnd | Filter Enable Band | 10 |
| PtS | Scaling Points – Use 2 of 16 possible | 2 |
| StYLE | Keyboard Entry or Calibration Applied | KEY or APLY |
| InP 1 | Low Input reading in MA | *4.000 |
| dSP 1 | Low Display Value in Pounds/Kilos | *0 |
| InP 2 | High Input reading in MA | *20.000 |
| dSP 2 | High Display Value in Pounds/Kilos | *10000 |

*Typical values for a 4-20ma sensor and a 0-10000 lb. Calibration.

**2-FNC** External Input and Function Key Parameters

| Display | Parameter | Setting |
|---|---|---|
| USr-1 | User Input 1 | PLOC |
| USr-2 | User Input 2 | nO |
| USr-3 | User Input 3 | nO |
| F1 | Function Key 1 | nO |
| F2 | Function Key 2 | nO |
| rSt | Reset Key | nO |
| Sc-F1 | Secondary Function Key 1 | nO |
| Sc-F2 | Secondary Function Key 2 | nO |

**3-LOC** Parameter Lockouts

| Display | Parameter | Setting |
|---|---|---|
| HI | Maximum Reading Display | LOC |
| LO | Minimum Reading Display | LOC |
| tOt | Total Reading Display | LOC |
| SP-1 | Setpoint 1 – Entry Enabled | Ent |
| SP-2 | Setpoint 2 | LOC |
| SP-3 | Setpoint 3 | LOC |
| SP-4 | Setpoint 4 | LOC |
| CodE | Security Code | 0 |

**4-SEC** Secondary Function Parameters

These parameters are not used at this time.

**5-tOt** Totalized Parameters

These parameters are not used at this time.

**6-SPt** Setpoint Parameters

| Display | Parameter | Setting |
|---|---|---|
| SPSEL | Select Setpoint | SP-1 |
| Act-1 | Action for Setpoint – Absolute High | Ab-HI |
| SP-1 | Setpoint Value – Alarm Limit | *1000 |
| Src-1** | Setpoint Source – Net Input Value | rEL |
| HYS-1 | Setpoint Hystersis | 2 |
| tOn-1 | On Time Delay | 0.0 |
| tOF-1 | Off Time Delay | 0.0 |
| Out-1 | Output Logic | Nor |
| rSt-1 | Reset Action | Auto |
| Stb-1 | Standby Action | no |
| Lit-1 | Output Panel Light | nor |

* Alarm limit value that can be changed from front panel after programming

****** Feature only available on the newer meters

**7-SrL** Serial communications Parameters

| Display | Parameter | Setting |
|---|---|---|
| bAUD | Baud Rate | 2400 |
| dAtA | Data Word Length | 7 |
| PAr | Parity | Odd |
| Addr | Meter Address | 2 |
| Abrv | Abbreviated Printing | no |
| OPt | Options | no |

**8-Out** Analog Output Parameters

| Display | Parameter | Setting |
|---|---|---|
| tYPE | Analog Type | 4-20 |
| AS In | Analog Assignment | InP |
| An-LO | Analog Low Scale Value | 0 |
| An-HI | Analog High Scale Value | 10000 |
| udt | Update Time | 0.0 |

9-FCS Factory Service Parameters

| Display | Parameter | Setting |
|---|---|---|
| d-LEv | Display Intensity Level | 3 |
| CodE | Factory Service Code | *** 50 |

*** Normally will show 50. To clear all setting to factory defaults enter 66.

Section

4

# 4 DTLS Through Warrior Software

## USB communications

The Warrior software communicates with the Depth Tension Line Speed Panel through USB. The panel needs to have a USB cable connected to the computer or through the computer through a USB hub (such as in the Scientific Data Systems, Inc. Interface Panel). The DTLS panel can be found in the Windows Device Manager as a Human Interface Device.

The Depth panel communications must be enabled through the Warrior Depth Control Window by Selecting USB for the Depth Panel - Panel Type and clicking on the [Connect] button.

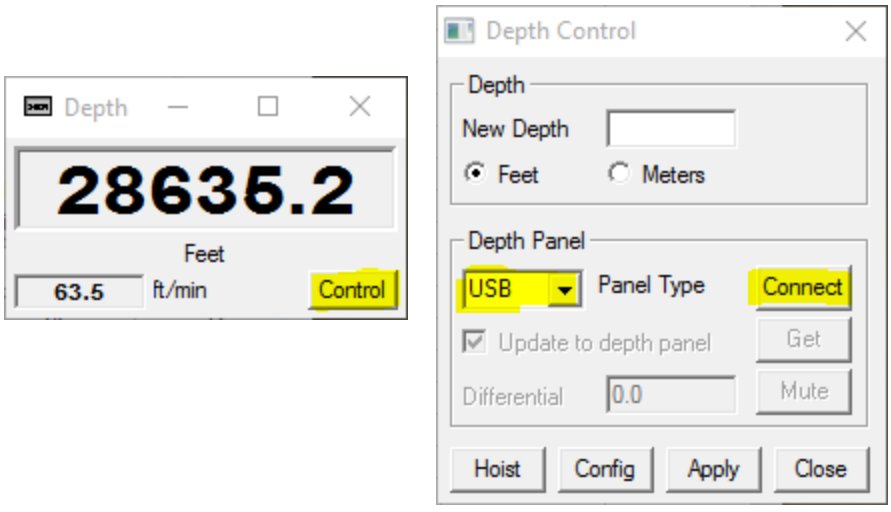



Fig. 4.1 Connecting to Depth Panel

Once the panel has been connected to the software, click the [ Config ] button to bring up the Depth Configuration Window.

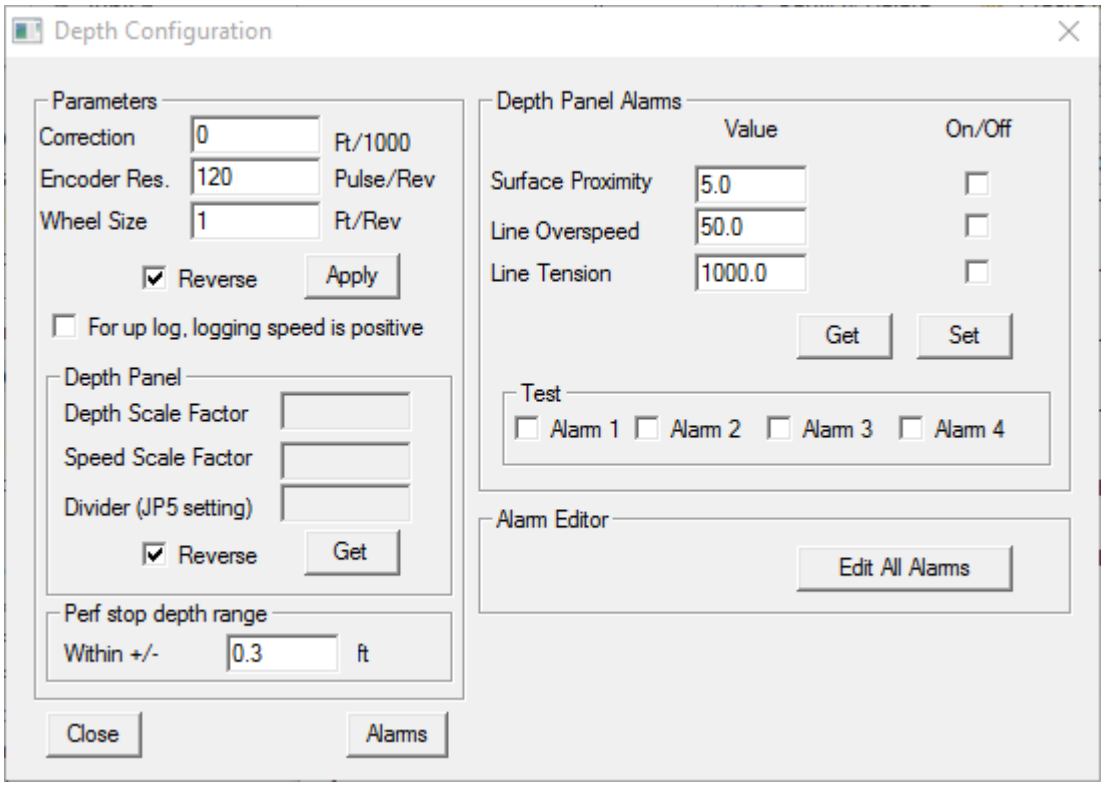


Fig. 4.2 Depth Configuration Window

If the [ Apply ] button is clicked in the parameters section, new scale factors will be written to the Depth 1 meter, Depth 2 meter, and the Line Speed section of the Depth 2 meter. The “Reverse” check box reverses the depth direction of the depth panel meters and the depth direction of the Warrior software.

By clicking on the [ Get ] button in the Depth Panel section, the scale factors of the meters may be read to verify settings. The “Reverse” check box reverses the depth direction of the depth panel meters only.

The alarms in the depth panel may be set through the Depth Panel Alarms section. Enter the desired alarm limits in the value windows and select whether the alarm is to be on or off (off sets unreachable limits in the panel meters) then click the [Set ] button to set the alarms. Current alarm values may be read by clicking the [ Get ] button. Note that no alarms will sound until at least one depth pulse has been received after the panel has been turned on.

The Test section has several alarm sequences that may be tested. Again note that the alarms will not sound until the panel has received at least one depth pulse after the panel has been turned on.

Section

5

# 5 DTLS Hardware

**Schematic 1**

Encoder pulses are buffered and fed into a quadrature detector ICI used to detect ppr and direction before being divided down by the jumper selection at J5. The buffered outputs as well are the outputs of the quadrature detector are all buffered out through IC7 to J1.

The voltage output to the encoder is selected by the J7 and is either +12v or +5v.
IC6 is a voltage input detector, if more than +12v is applied to the panel SCR Q1 is triggered shorting the input power and tripping the fuse.

U1 is a 12v to 5v converter used to provide circuit power as well as encoder panel is selected.

**Schematic 2**

IC11 and IC10 handle the RS232 communications between the main board and the two depth displays. The received signal is fed into a nand gate were any serial data input from the tension meter via IC12 are merged then inverted and sent into the micro controller on pin 30. The TX output to the meters is also fed out to the meters through IC10, 11 and 12.

Input alarms from the tree meters enter on J9, they are connected to pull up resisters before being buffered into the micro controller. Outputs from the micro controller to the son and lmp alarms are also buffered out through J9.

The combination of IC13 and IC3 is used to prevent the occurrence of false alarms.

**Schematic 3**

This page contains the micro controller and associated hardware.

IC9  is the serial EPROM used to program the microcontroller on power up.

IC15is a diode protection for the incoming and outgoing USB signals.

IC14 is a 5v to 3.3v dc to dc converter used to power the microcontroller, EPROM and usb protection circuit.

Fig 6.1 Schematic page 1

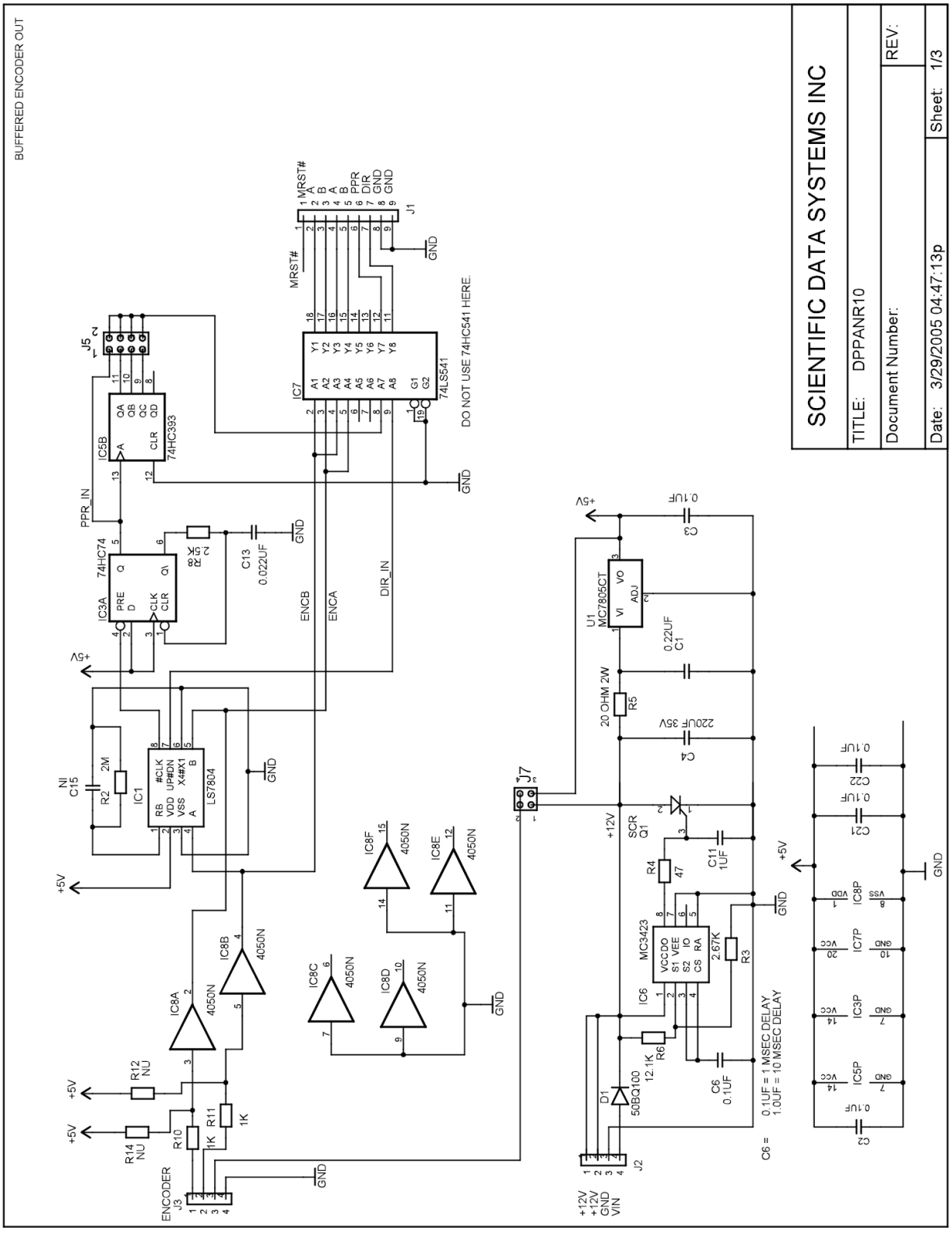



Fig 6.2 Schematic page 2

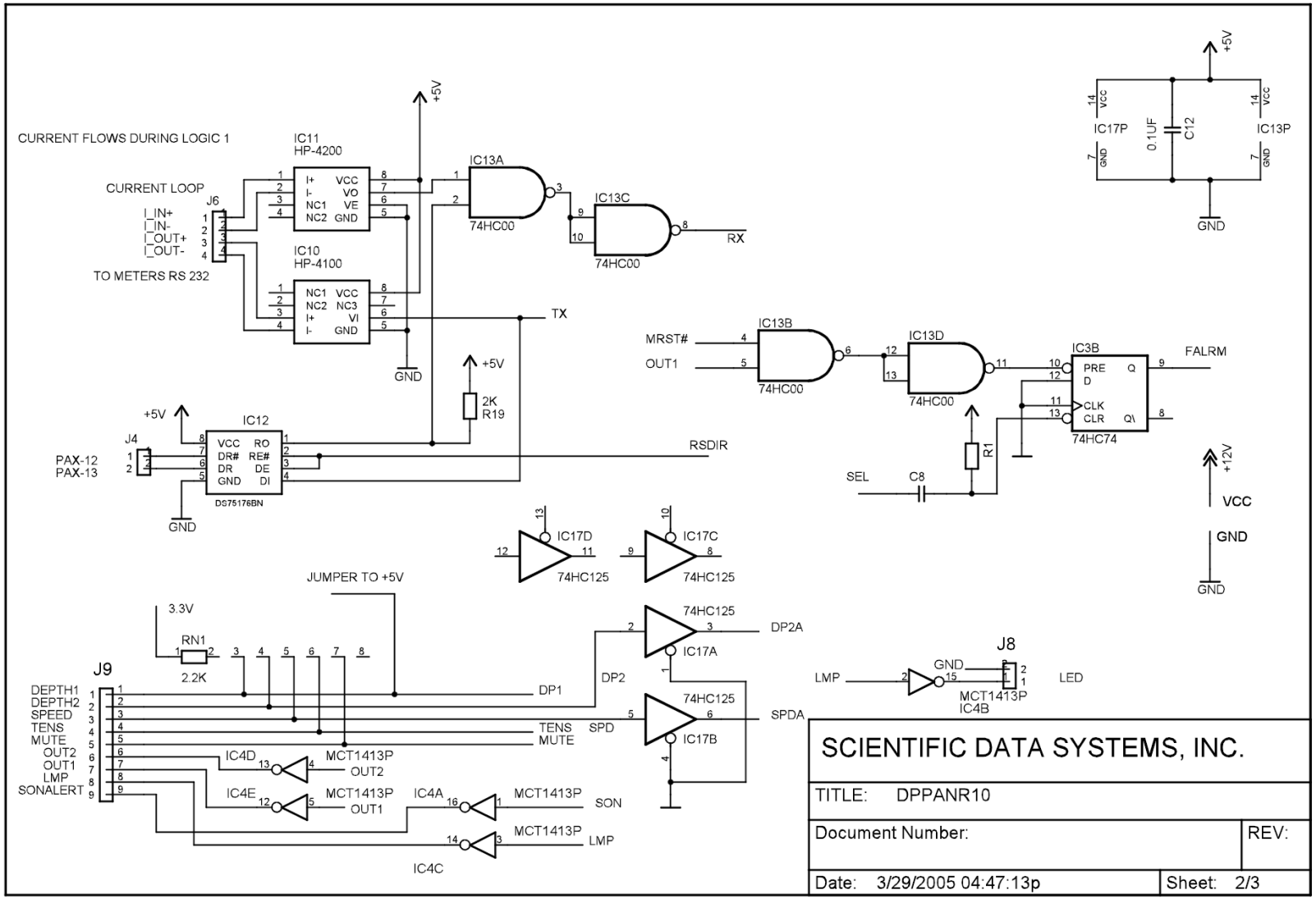

CURRENT FLOWS DURING LOGIC 1
CURRENT LOOP
I_IN+
I_IN-
I_OUT+
I_OUT-
J6
TO METERS RS 232
IC11
HP-4200
I+ VCC
I- VO
NC1 VE
NC2 GND
IC10
HP-4100
NC1 VCC
NC2 NC3
I+ VI
I- GND
+5V
GND
IC13A
74HC00
IC13C
74HC00
RX
TX
2K
R19
IC12
VCC RO
DR# RE#
DR DE
GND DI
DS75176BN
J4
PAX-12
PAX-13
RSDIR
IC13B
74HC00
IC13D
74HC00
MRST#
OUT1
IC3B
PRE Q
D
CLK
CLR Q\
74HC74
FALRM
R1
SEL
C8
IC17P
IC13P
0.1UF
C12
VCC
GND
+12V
VCC
GND
IC17D
74HC125
IC17C
74HC125
JUMPER TO +5V
3.3V
RN1
2.2K
J9
DEPTH1
DEPTH2
SPEED
TENS
MUTE
OUT2
OUT1
LMP
SONALERT
DP1
DP2
TENS
MUTE
SPD
74HC125
IC17A
DP2A
74HC125
IC17B
SPDA
IC4D
MCT1413P
OUT2
IC4E
MCT1413P
OUT1
IC4A
MCT1413P
SON
MCT1413P
LMP
IC4C
J8
GND
LMP
LED
MCT1413P
IC4B
SCIENTIFIC DATA SYSTEMS, INC.
TITLE: DPPANR10
Document Number:
REV:
Date: 3/29/2005 04:47:13p
Sheet: 2/3

Fig 6.3 Schematic page 3

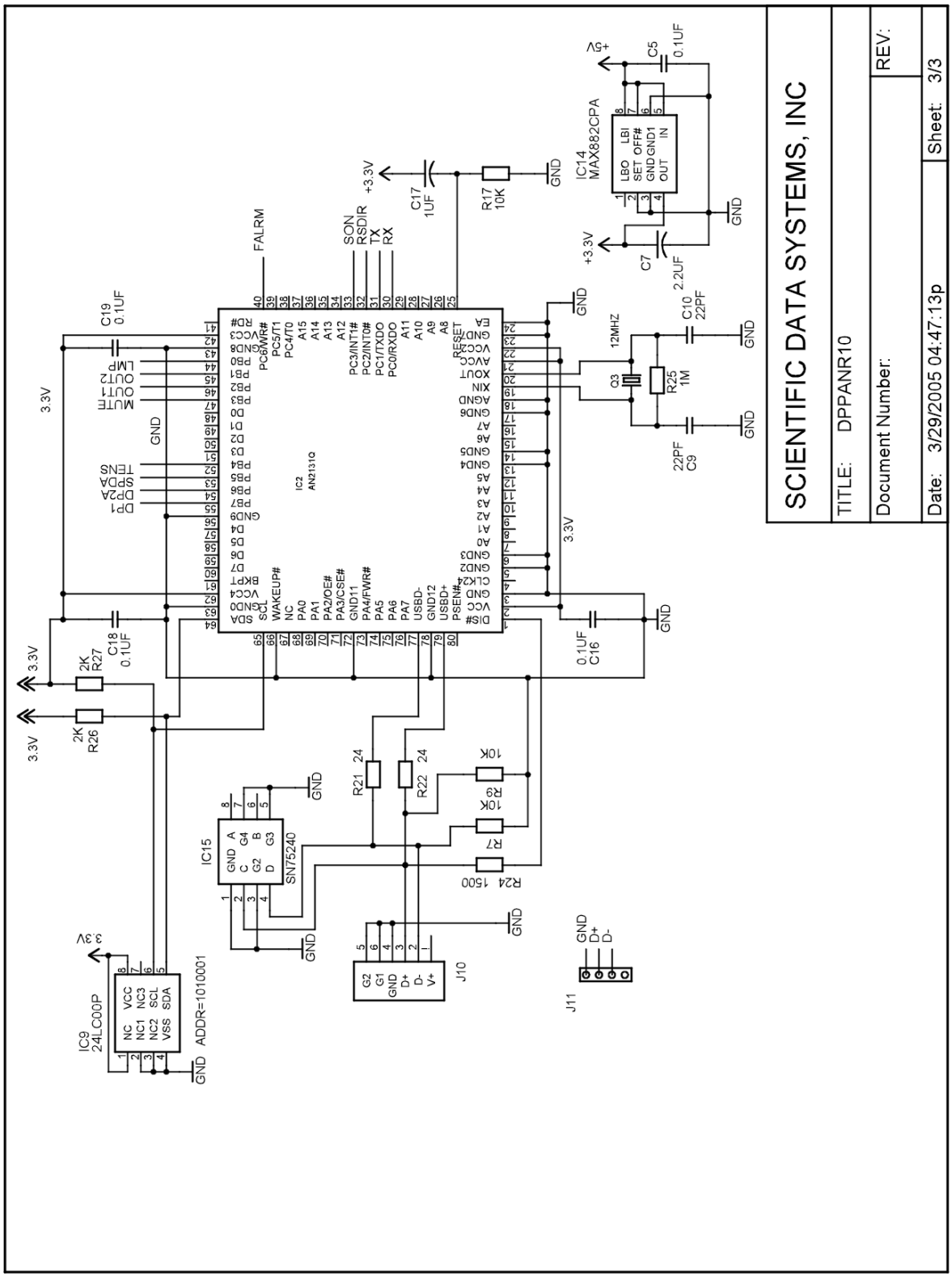


Fig 6.4 PCB

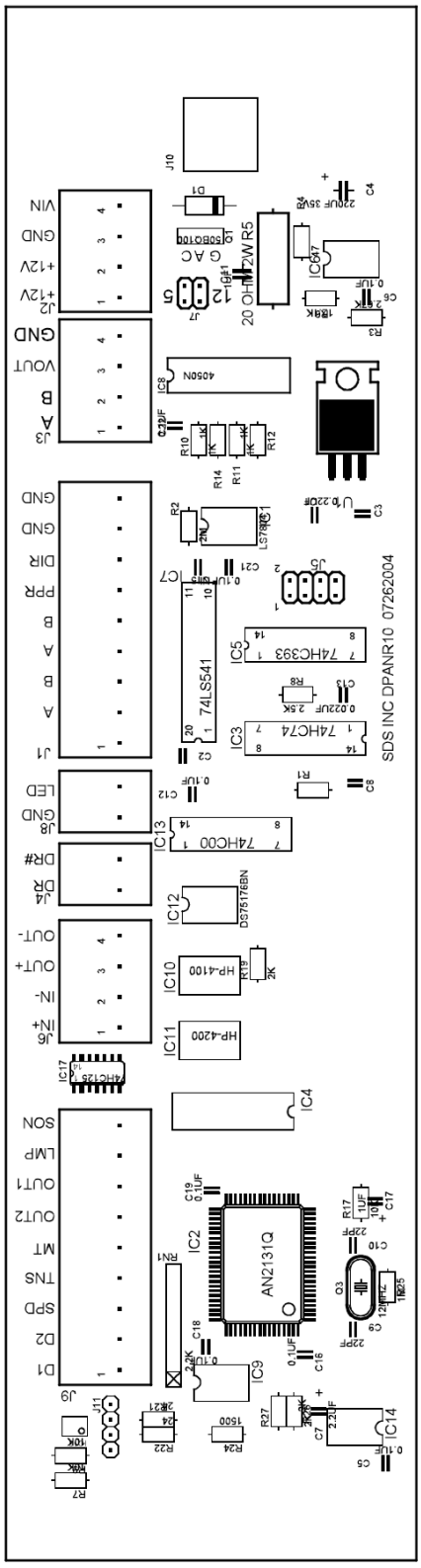
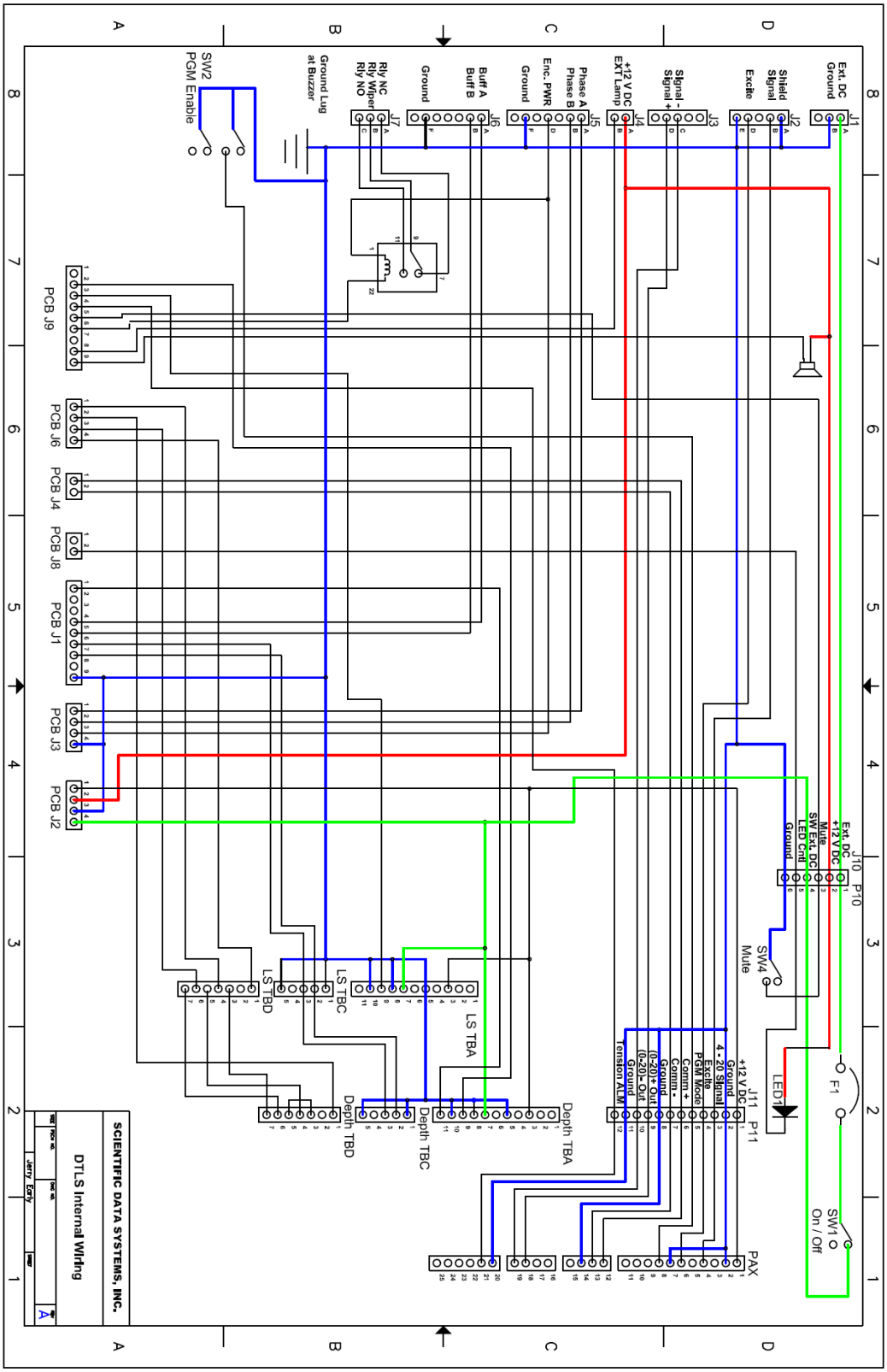

SDS INC DPANR10 07262004
AN2131Q
74LS541
74HC393
74HC74
74HC00
74HC125
HP-4100
HP-4200
DS75176BN
405ON
20 OHM 2W R5
VIN
GND
+12V
+12V
GND
VOUT
B
A
GND
GND
DIR
PPR
B
A
B
A
LED
GND
DR#
DR
OUT-
OUT+
IN-
IN+
SDN
LMP
OUT1
OUT2
MT
TNS
SPD
D2
D1

Fig 6.5 Wiring Diagram

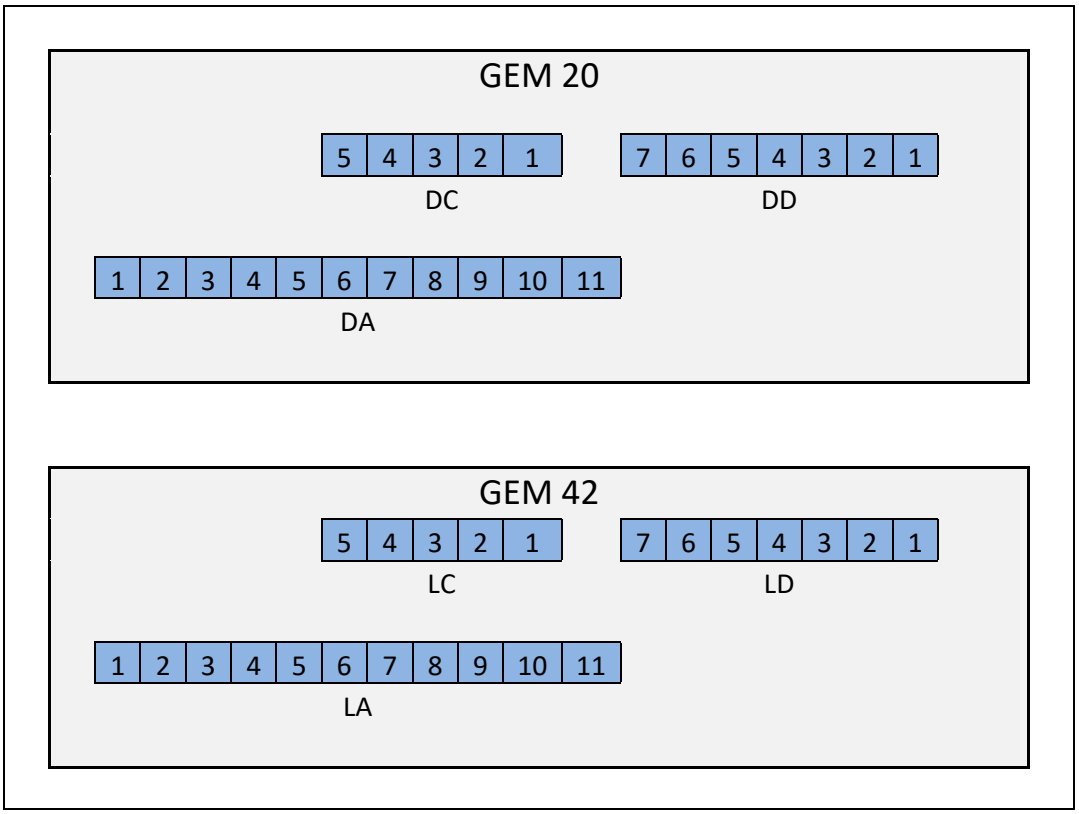


Section

6

# 6 DTLS Hardware

The following figure shows the rear connects on the GEM 20 Depth Meter and the GEM 42 Line Speed Meter.



# WIRELIST DEPTH PANEL - USB

## Rear Panel Connectors

| | | | | |
|---|---|---|---|---|
| **J1** | DC Power In | | | |
| | J1-A | J10-1 | | +12V Battery |
| | J1-B | SW2-2/5 | GND LUG | Chassis Ground |
| **J2** | Line Weight Input from Transducer | | | |
| | J2-A | J2-E | | GND |
| | J2-B | J11-3 | | 4-20ma Signal |
| | J2-D | J11-4 | | +12V Excite |
| | J2-E | J5-F | J2-A | GND |
| **J3** | Line Weight Retransmit to System | | | |
| | J3-C | J11-10 | | PAX Analog 19 -(0-20)Out |
| | J3-D | J11-9 | | PAX Analog 18 +(0-20)Out |
| **J4** | External Lamp or Alarm | | | |
| | J4-A | PCB_J2-2 | BZ+ | +12V Reg |
| | J4-B | PCB_J9-8 | | External Lamp |
| **J5** | Quadrature Encoder Input | | | |
| | J5-A | PCB_J3-1 | | Encoder A |
| | J5-B | PCB_J3-2 | | Encoder B |
| | J5-D | PCB_J3-3 | Relay-1 | Encoder Power |
| | J5-F | J2-E | J6-F | GND |
| **J6** | Buffered Quadrature to System | | | |
| | J6-A | PCB_J1-4 | | Buffered A |
| | J6-B | PCB_J1-5 | | Buffered B |
| | J6-F | J5-F | GND LUG | GND |
| **J7** | Alarm Relay | | | |
| | J7-A | Relay-7 | | Relay NC |
| | J7-B | Relay-9 | | Relay Wiper |
| | J7-C | Relay-11 | | Relay NO |
| **J7** | Buffered Quadrature Spare (Optional J7 Wiring) | | | |
| | J7-A | PCB_J1-2 | | Buffered A |
| | J7-B | PCB_J1-3 | | Buffered B |
| | J7-C | J6-F | GND LUG | GND |
| **J8** | USB Port to Computer<br>Connected Directly to Board | | | |

| J10 | Front Panel Controls | |
|---|---|---|
| J10-1 | J1-A | +12V Battery |
| J10-2 | BZ+ | Reg 12V - LED |
| J10-3 | PCB_J9-5 | Mute Switch |
| J10-4 | PCB_J2-4 | Switched 12 Volt |
| J10-5 | PCB_J8-2 | Led Control |
| J10-6 | GND LUG | GND |

| P10 | Front Panel Controls | |
|---|---|---|
| P10-1 | F1-2 | +12V Battery |
| P10-2 | LED RED | Reg 12V - LED |
| P10-3 | SW4-2 | Mute Switch |
| P10-4 | SW1-1 | Switched 12 Volt |
| P10-5 | LED WHT | Led Control |
| P10-6 | SW4-1 | GND |

| J11 | Line Tension Meter | |
|---|---|---|
| J11-1 | PCB_J2-1 | Reg 12 Volt |
| J11-2 | GND LUG | GND |
| J11-3 | J2-B | 4-20ma Signal |
| J11-4 | J2-D | +12V Excite |
| J11-5 | SW2-3 | PGM Mode |
| J11-6 | PCB_J4-1 | DR+ |
| J11-7 | PCB_J4-2 | DR- |
| J11-8 | GND LUG | GND |
| J11-9 | J3-D | PAX Analog 18 +(0-20)Out |
| J11-10 | J3-C | PAX Analog 19 -(0-20)Out |
| J11-11 | GND LUG | GND |
| J11-12 | PCB_J9-4 | TNS ALM |

| P11 | Line Tension Meter | |
|---|---|---|
| P11-1 | PAX-1 | Reg 12 Volt |
| P11-2 | PAX-2 | GND |
| P11-3 | PAX-4 | 4-20ma Signal |
| P11-4 | PAX-6 | +12V Excite |
| P11-5 | PAX-8 | PGM Mode |
| P11-6 | PAX-12 | DR+ |
| P11-7 | PAX-13 | DR- |
| P11-8 | PAX-14 | GND |
| P11-9 | PAX-18 | +(0-20)Out |
| P11-10 | PAX-19 | -(0-20)Out |
| P11-11 | PAX-20 | GND |
| P11-12 | PAX-21 | TNS ALM |

| PAX | Line Tension Meter | | | |
|---|---|---|---|---|
| | PAX-1 | P11-1 | | Reg 12 Volt |
| | PAX-2 | PAX-7 | P11-2 | GND |
| | PAX-4 | P11-3 | | 4-20ma Signal |
| | PAX-6 | P11-4 | | +12V Excite |
| | PAX-7 | PAX-2 | | GND |
| | PAX-8 | P11-5 | | PGM Mode |
| | PAX-12 | P11-6 | | DR+ |
| | PAX-13 | P11-7 | | DR- |
| | PAX-14 | P11-8 | | GND |
| | PAX-18 | P11-9 | | +(0-20)Out |
| | PAX-19 | P11-10 | | -(0-20)Out |
| | PAX-20 | P11-11 | | GND |
| | PAX-21 | P11-12 | | TNS ALM |

## Depth and Line Speed

| DP_TBA | DEPTH Meter TBA - Control | | | |
|---|---|---|---|---|
| | DP_TBA-3 | LS_TBA-3 | PCB_J2-1 | +12V |
| | DP_TBA-5 | DP_TBA-8 | DP_TBC-5 | GND |
| | DP_TBA-7 | LS_TBA-7 | SW2-6 | PGM Mode |
| | DP_TBA-8 | DP_TBA-10 | DP_TBA-5 | GND |
| | DP_TBA-9 | PCB_J9-2 | | Depth ALM |
| | DP_TBA-10 | DP_TBA-8 | LS_TBC-1 | GND |
| | DP_TBA-11 | PCB_J1-1 | | Reset |

| DP_TBC | Depth Meter TBC - Depth | | | |
|---|---|---|---|---|
| | DP_TBC-1 | DP_TBC-5 | PCB_J2-3 | GND |
| | DP_TBC-2 | LS_TBC-2 | PCB_J1-7 | DIR |
| | DP_TBC-3 | LS_TBC-3 | PCB_J1-6 | PPR |
| | DP_TBC-5 | DP_TBA-5 | DP_TBC-1 | GND |

| DP_TBD | Depth Meter TBD - Communications | | |
|---|---|---|---|
| | DP_TBD-1 | PCB_J6-2 | Meter Communications |
| | DP_TBD-3 | DP_TBD-5 | Meter Communications |
| | DP_TBD-4 | LS_TBD-5 | Meter Communications |
| | DP_TBD-5 | DP_TBD-3 | Meter Communications |
| | DP_TBD-6 | LS_TBD-7 | Meter Communications |
| | DP_TBD-7 | LS_TBD-3 | Meter Communications |

| LS_TBA | Line Speed Meter TBA - Control | | | |
|---|---|---|---|---|
| | LS_TBA-3 | DP_TBA-3 | | +12V |
| | LS_TBA-5 | LS_TBA-8 | LS_TBC-5 | GND |
| | LS_TBA-7 | DP_TBA-7 | | PGM Mode |
| | LS_TBA-8 | LS_TBA-10 | LS_TBA-5 | GND |
| | LS_TBA-9 | PCB_J9-3 | | SPD ALM |
| | LS_TBA-10 | LS_TBA-8 | | GND |

| LS_TBC | Line Speed Meter TBC - Depth | | | |
|---|---|---|---|---|
| | LS_TBC-1 | LS_TBC-5 | DP_TBA-10 | GND |
| | LS_TBC-2 | DP_TBC-2 | | DIR |
| | LS_TBC-3 | DP_TBC-3 | | PPR |
| | LS_TBC-5 | LS_TBA-5 | LS_TBC-1 | GND |

| LS_TBD | Line Speed Meter TBD - Communications | | | |
|---|---|---|---|---|
| | LS_TBD-1 | PCB_J6-4 | | Meter Communications |
| | LS_TBD-3 | DP_TBD-7 | | Meter Communications |
| | LS_TBD-4 | PCB_J6-1 | | Meter Communications |
| | LS_TBD-5 | DP_TBD-4 | | Meter Communications |
| | LS_TBD-6 | PCB_J6-3 | | Meter Communications |
| | LS_TBD-7 | DP_TBD-6 | | Meter Communications |

## PC Board Connectors

| PCB_J1 | Encoder Connections | | | |
|---|---|---|---|---|
| | PCB_J1-1 | DP_TBA-11 | | Reset |
| | PCB_J1-2 | J7-A | *(Optional Wiring)* | Buffered A |
| | PCB_J1-3 | J7-B | *(Optional Wiring)* | Buffered B |
| | PCB_J1-4 | J6-A | | Buffered A |
| | PCB_J1-5 | J6-B | | Buffered B |
| | PCB_J1-6 | DP_TBC-3 | | PPR |
| | PCB_J1-7 | DP_TBC-2 | | DIR |
| | PCB_J1-9 | PCB_J3-4 | GND LUG | GND |

| PCB_J2 | 12 Volt Power Distribution | | | |
|---|---|---|---|---|
| | PCB_J2-1 | DP_TBA-3 | J11-1 | Reg 12 Volt |
| | PCB_J2-2 | J4-A | | Reg 12V - LED & Buzzer |
| | PCB_J2-3 | DP_TBC-1 | GND LUG | GND |
| | PCB_J2-4 | J10-4 | | Switched 12 Volt |

| PCB_J3 | Encoder Connections | | |
|---|---|---|---|
| | PCB_J3-1 | J5-A | Encoder A |
| | PCB_J3-2 | J5-B | Encoder B |
| | PCB_J3-3 | J5-D | Encoder Power |
| | PCB_J3-4 | PCB_J1-9 | GND |

| PCB_J4 | PAX Tension Meter Communications | | |
|---|---|---|---|
| | PCB_J4-1 | J11-6 | DR+ |
| | PCB_J4-2 | J11-7 | DR- |

| PCB_J6 | Depth Meter Communications | | |
|---|---|---|---|
| | PCB_J6-1 | LS_TBD-4 | Meter Communications |
| | PCB_J6-2 | DP_TBD-1 | Meter Communications |
| | PCB_J6-3 | LS_TBD-6 | Meter Communications |
| | PCB_J6-4 | LS_TBD-1 | Meter Communications |

| PCB_J8 | Alarm Set LED | | |
|---|---|---|---|
| | PCB_J8-1 | | GND |
| | PCB_J8-2 | J10-5 | Led Control |

| PCB_J9 | Alarm Controls | | |
|---|---|---|---|
| | PCB_J9-1 | | |
| | PCB_J9-2 | DP_TBA-9 | Depth ALM |
| | PCB_J9-3 | LS_TBA-9 | SPD ALM |
| | PCB_J9-4 | J11-12 | TNS ALM |
| | PCB_J9-5 | J10-3 | Mute Switch |
| | PCB_J9-6 | Relay-22 | Relay Control |
| | PCB_J9-8 | J4-B | External Lamp |
| | PCB_J9-9 | BZ- | Buzz Control |

## Misc. Items

| F1 | Fuse | | |
|---|---|---|---|
| | F1-2 | SW1-2 | +12V Battery |
| | F1-2 | P10-1 | Fused +12V |

| SW1 | Power on/off | | |
|---|---|---|---|
| | SW1-1 | P10-4 | Switched 12 Volt |
| | SW1-2 | F1-1 | Fused +12V |

| SW2 | Program Mode | | | |
|---|---|---|---|---|
| | SW2-2 | SW2-5 | J1-B | GND |
| | SW2-3 | J11-5 | | PGM Mode |
| | SW2-5 | SW2-2 | J1-B | GND |
| | SW2-6 | DP_TBA-7 | | PGM Mode |

| SW4 | Mute Button | | |
|---|---|---|---|
| | SW4-1 | P10-6 | GND |
| | SW4-2 | P10-3 | Mute Switch |

| LED | Alarm Indicator | | |
|---|---|---|---|
| | RED | P10-2 | Reg 12V - LED |
| | WHT | P10-5 | Led Control |

| BUZZER | | | | |
|---|---|---|---|---|
| | BZ+ | J4-A | J10-2 | Reg +12 |
| | BZ- | PCB_J9-9 | | Buzz Control |

| GND LUG | | | | |
|---|---|---|---|---|
| | PCB_J2-3 | PCB_J1-9 | J1-B | J6-F |
| | J10-6 | J11-2 | J11-8 | J11-11 |

| RELAY | | | |
|---|---|---|---|
| | Relay-1 | J5-D | Control Voltage |
| | Relay-7 | J7-A | Relay NC |
| | Relay-9 | J7-B | Relay Wiper |
| | Relay-11 | J7-C | Relay NO |
| | Relay-22 | PCB_J9-6 | Relay Control |