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Distributed Data Collection Module (DDC)

Interface Control Document

APPENDIX A INTERFACE CONTROL DOCUMENTS (ICD)

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US 6,859,163.
US 6,803,875.
US 7,049,997

Various additional domestic and international patents have been applied for.

Validity Date: 08 Mar 07

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1.0 DDC Module Description

The Distributed Data Collection (DDC) module is an Ethernet or serial RS232 controlled device that collects both analog and digital data, controls relays, sources outputs, generates triggers in local mode and buffers triggers in remote mode.

FIGURE 1 - DDC MODULE

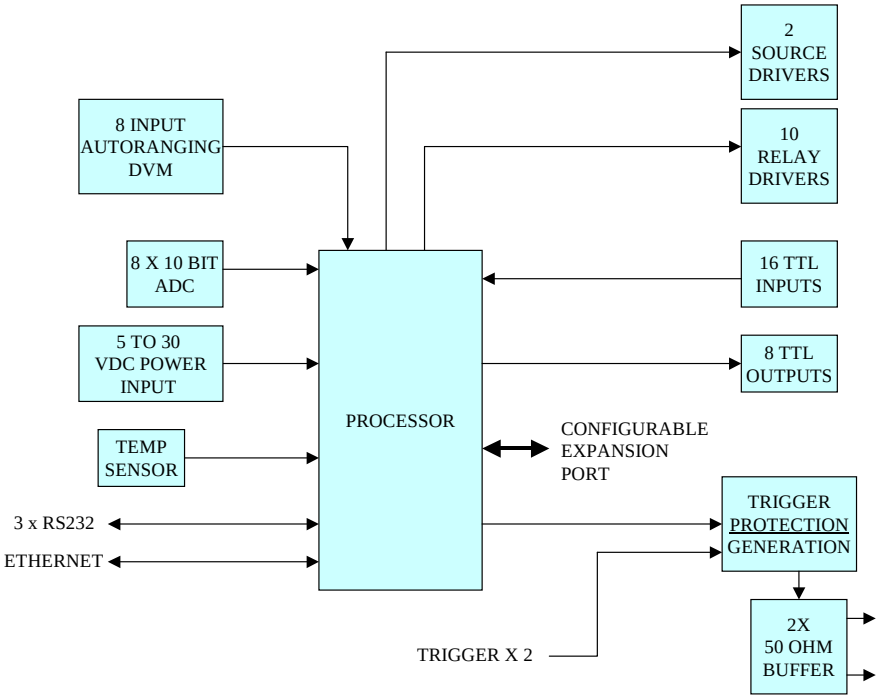


FIGURE 2 – DDC Block Diagram

2.0 DDC Hardware Interface

2.1 DDC General Specifications

The DDC module uses a Motorola 5282, 32-Bit processor core module with Ethernet on a Carrier PCA. The Carrier PCA handles all power supply requirements and signal conditioning for the core processor module. A Complex Programmable Logic Device (CPLD) is included on the carrier PCA to handle logic and expansion. Serial ports are buffered on the carrier PCA and routed to the core processor module.

General specifications are listed in Table 1

Specification	Value	
Power supply	+5 to +30 VDC	250mA
Temperature	-20 to +120	Deg. F
RS232 Serial ports	3	
10 bit ADC channels	8	0-5VDC
DC Voltmeter Inputs	8	+-200 VDC
Discrete Inputs	16	0-30 VDC
TTL outputs	8	40mA
Sink Relay drive outputs	10	150mA
Source +24VDC outputs	2	500mA
Trigger inputs	2	24V peak
Trigger outputs	2	15V or 5V
Programmable Expansion	16	TTL
10/100 Ethernet port	1	10/100

Table 1 - DDC Specifications

2.2 RS232 Ports (J1)

The three DDC RS232 ports are accessible through the 9-pin D connector, J1 are listed in Table 2.

Serial Port		Usage
Port 0		Processor console
Port 1		General purpose
Port 2		General purpose

Table 2 - RS232 Serial Ports

2.2.1 RS232 Pinouts on J1

The RS232 uses a 9 pin D connector but it is used in a NON-STANDARD way: all three serial ports reside on this connector. These communication ports are simple TX/RX serial ports and do not have hardware flow control.

Pin	Function
1	Ground
2	Port 0 RX
3	Port 0 TX
4	Ground
5	Ground
6	Port 1 TX
7	Port 1 RX
8	Port 2 TX
9	Port 2 RX

Table 3 – RS232 Pinout

2.3 Power Input(J2)

2.3.1 Power Pinouts on J2

The DDC module has an on board wide range switcher power supply that can be supplied with a input voltage range of +5VDC to +30VDC.

Pin	Function
1	
2	
3	Ground
4	+24vDC in
5	N/C
6	+24vDC in
7	
8	
9	Ground

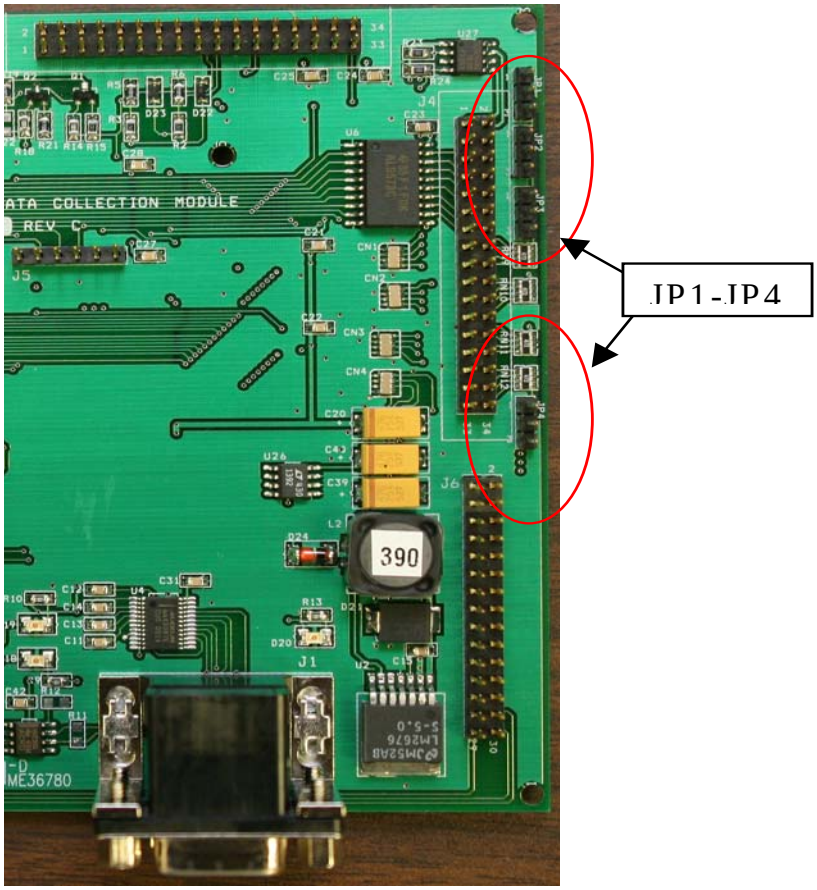
Table 4 – Power Pinout

2.4 I/O Ports (J3,J4)

FIGURE 11 - DISTRIBUTED DATA COLLECTION MODULE (DDC), OPEN

The sixteen wide range discrete DDC inputs are connected to the 37 pin D connector J4. Each group of four discrete inputs has an associated pull-up selector, JP1 – JP4. By connecting a jumper between pins 1 & 2 a pull-up will be supplied via 4.7K Ohm resistor to +5VDC. Connecting a jumper between pins 2 & 3 will supply a +24 VDC pull-up voltage via the same 4.7K Ohm resistor. Each discrete input is buffered by a 4.7K Ohm resistor and then Zener diode regulated to 5.1 volts. A 0.1 μF capacitor is used as a filter on each discrete input. Any one of the 16 discrete inputs can recognize a 1.7 to 30 volt signal without damage to circuits.

JP1 – JP4	Pins	J4 Pin	Pullup
JP1	1&2	8,9,27,28	+5V
JP1	2&3		+24VDC
JP2	1&2	11,12,29,30	+5V
JP2	2&3		+24VDC
JP3	1&2	13,14,32,33	+5V
JP3	2&3		+24VDC
JP4	1&2	16,17,35,36	+5V
JP4	2&3		+24VDC



The eight buffered TTL outputs are connected to the 37 pin D connector, J4,

The eight analog to digital inputs (ADC) with a resolution of 10 bits are connected to the 37 pin D connector J3. Each input is filtered by a 0.1 μF capacitor. The reference voltage for the ADC is 5.0 volts. Input range is from 0 to +5 VDC.

The eight Sink Driver outputs are connected to the 37 pin D connector, J3. Each sink driver can sink up to 150mA at up to +24VDC. Each sink driver is equipped with a current protection diode for driving relays or inductive loads.

The auto-ranging DC voltmeter circuit allows the DDC to be connected to a wide range of bi-polar inputs. Voltage inputs can be bi-polar from 0 to 200 volts. The input impedance is 1 Meg Ohm. There are 8 inputs and 2 grounds. Access to the 8 individual voltmeter inputs are through the J2 10-circuit screw down terminal block connector.

The DDC module incorporates a digital trigger protection circuit that allows for the input of two separate triggers. Trigger inputs are on 37 pin D connector J3 pins 10 and 11. Each trigger input is 50 Ohm terminated and can withstand trigger pulses up to 25 V peak with duty up to 50% without damage to circuits. PRF maximums are set in memory and can be changed at

any time using the Ethernet or serial interface. The DDC provides trigger generation circuitry for local mode testing of the transmitter. The internal/external trigger mode is selectable via the Ethernet or serial interface and generates 1007 PRF and 250 PRF. Trigger outputs are on the same 37pin D connector J3 pins 23 and 33.

2.4.1 I/O Pinouts on J4

I/O Connector J4		
Pin	Function	Capability
1	+24 Source 1	+24VDC Switched @500mA
2	K9	Relay drive @150mA
3	Dout1	TTL output @40mA
4	Dout3	TTL output @40mA
5	Gnd	
6	Dout6	TTL output @40mA
7	Dout8	TTL output @40mA
8	Din1	0-30VDC discrete input
9	Din3	0-30VDC discrete input
10	Gnd	
11	Din6	0-30VDC discrete input
12	Din8	0-30VDC discrete input
13	Din9	0-30VDC discrete input
14	Din11	0-30VDC discrete input
15	Gnd	
16	Din14	0-30VDC discrete input
17	Din16	0-30VDC discrete input
18	NC	
19	NC	
20	+24V Source 2	+24VDC Switched @500mA
21	K10	Relay drive @150mA
22	Dout2	TTL output @40mA
23	Dout4	TTL output @40mA
24	Dout5	TTL output @40mA
25	Dout7	TTL output @40mA
26	Gnd	
27	Din2	0-30VDC discrete input
28	Din4	0-30VDC discrete input

I/O Connector J4		
Pin	Function	Capability
29	Din5	0-30VDC discrete input
30	Din7	0-30VDC discrete input
31	Gnd	
32	Din10	0-30VDC discrete input
33	Din12	0-30VDC discrete input
34	Din13	0-30VDC discrete input
35	Din15	0-30VDC discrete input
36	Gnd	
37	NC	

2.4.2 I/O Pinouts on J3

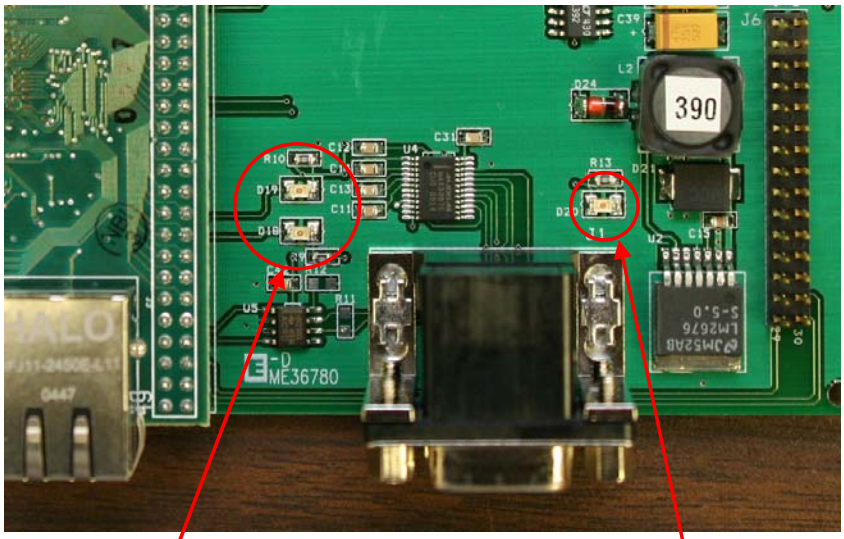
I/O Connector J4		
Pin	Input/ Output	Capability
1	AN3	10bit ADC input 0-5VDC
2	AN2	10bit ADC input 0-5VDC
3	AN0	10bit ADC input 0-5VDC
4	AN52	10bit ADC input 0-5VDC
5	Gnd	
6	Gnd	
7	Gnd	
8	Gnd	
9	+5VDC	VCC
10	TrigIn1	0-30V Pulsed Input
11	TrigIn2	0-30V Pulsed Input
12	TrigOut1	15V or 5V Drive output
13	K8	Relay drive @150mA
14	K6	Relay drive @150mA
15	K4	Relay drive @150mA
16	K2	Relay drive @150mA
17	TrigOut2	5V Drive output
18	NC	
19	NC	
20	AN1	10bit ADC input 0-5VDC
21	AN56	10bit ADC input 0-5VDC
22	AN53	10bit ADC input 0-5VDC
23	AN55	10bit ADC input 0-5VDC

I/O Connector J4		
Pin	Input/ Output	Capability
24	Gnd	
25	Gnd	
26	Gnd	
27	Gnd	
28	+5VDC	VCC
29	Gnd	
30	Gnd	
31	Gnd	
32	K7	Relay drive @150mA
33	K5	Relay drive @150mA
34	K3	Relay drive @150mA
35	K1	Relay drive @150mA
36	Gnd	
37	NC	

2.5 Ethernet (J5)

The Ethernet jack (J5) is located in the rear face of the DDC. This is a standard 10/100-Base-T Ethernet connection jack.

2.6 LED indicators



The DDC module has three LEDs that are used for the following indications:

Indicator	Function
LED 1	Processor running. This LED should blink regularly.
LED 2	Communications link established. This LED should blink regularly.
RS232	RS232 receive level present. This LED should be lit when a good RS232 receive level is detected on any of the three RS232 ports.

3.0 Command Shell

The radar system can be controlled by connecting to TCP port 23 of the Transmitter DDC. Interaction with the control microprocessor consists of sending ASCII text strings terminated by either a CR (0xD) or NL (0xA). The microprocessor responds to commands by emitting a one line response that consists of an error code and response message terminated by a CR-NL pair.

COMMAND
az_offset

DESCRIPTION
Sets the antenna azimuth alignment offset value

ARGUMENTS
angle Azimuth Offset Angle (0 – 359.9)

RETURN VALUE
0 ok

COMMAND
bite

DESCRIPTION
Returns a system bite report.

ARGUMENTS
none

TOKENS
NOTE: Tokens are subject to change based on system configuration.

Token	Description
tx_status_age	Age of transmitter DDC report in integer seconds
tx_control_timeout	Transmitter Host Communication Timeout false = comm ok true = comm timeout
local	Local Mode Status false = remote true = local
radar_pwr	Radar Power Status on = Transmitter On off = Transmitter Off
mod_pwr	Modulator Power Status on = Modulator On off = Modulator Off
tx_warmup	Transmitter warm-up cycle counter in seconds
tx_warmup_done	Transmitter Warm-up Cycle Complete false = warm-up incomplete true = warm-up complete
tx_safe	Transmitter External Hardware Safe/Interlock Input low = interlock closed high = interlock open
interlock	Transmitter Interlock Status false = interlock open true = interlock closed
standby	Radiate Standby Status false = waiting for standby true = standby

Token	Description
radiate	Radiation Status off = radiation off on = radiation on
wg_press	Waveguide Pressure Status low = ok high = fault
hot_box_door	Hot Box Door Status low = closed high = open
mag_air	Magnetron Blower Status low = ok high = fault
tx_cab_temp	Transmitter Cabinet Temperature Degrees Celsius
hot_box_temp	Hot Box Temperature Degrees Celsius
pwid	Current Pulse Width Index 0x0 = .4 us 0x1 = .8 us 0x2 = 1.0 us 0x3 = 2.0 us
trig_src	Trigger Source ext = external trigger int = internal trigger
itrigclk	Local Mode Trigger Clock Select fast = Fast Clock (1063 Hz) slow = Slow Clock (253 Hz)
hvps_v	High Voltage Power Supply Voltage
hvps_i	High Voltage Power Supply Current
mag_i	Magnetron Current
trigger_present	Trigger Present Input low = Trigger Detected high = Trigger Not Detected
filament_timeout	Filament Timeout Status
filament_fault	Filament Fault Status
rx_sw_status_age	Age of RF switch driver report in seconds
rx_status_age	Age of Receiver DDC report in seconds
afc_v	AFC Voltage
rx_p15v_1	Receiver +15 Volt Power Supply # 1
rx_p15v_2	Receiver +15 Volt Power Supply # 2
rx_p15v_3	Receiver +15 Volt Power Supply # 3
rx_p12v	Receiver +12 Volt Power Supply
rx_p24v	Receiver +24 Volt Power Supply
rx_ac_pwr	Receiver Air Conditioner Power on = Air Conditioner On off = Air Conditioner Off

Token	Description
rx_temp_1	Receiver Temperature Sensor # 1
rx_temp_2	Receiver Temperature Sensor # 2
rx_temp_3	Receiver Temperature Sensor # 3
rx_humidity	Receiver Enclosure Relative Humidity
rf_sw_mode	RF Switch Mode 0 = Simultaneous Dual Polarization 1 = Vertical Polarization 2 = Horizontal Polarization
forward_pwr	DPPM forward power
reverse_pwr	DPPM reverse power
measured_prf	DPPM PRF measurement
vswr_fault	VSWR Fault false = ok true = fault
vswr_under_range	Reverse power is too low for DPPM to accurately measure VSWR
ped_status_age	Age of UPC status report in integer seconds
servo_pwr	Servo Power on = Servo Power On off = Servo Power Off
az	Current Azimuth
el	Current Elevation
az_offset	Azimuth Offset Value
el_offset	Elevation Offset Value
az_safe	Azimuth Safe true = Azimuth Safe false = Azimuth Operate
el_safe	Elevation Safe true = Elevation Safe false = Elevation Operate
az_motor_online	Azimuth Motor Online true = Azimuth Motor Online false = Azimuth Motor Offline
el_motor_online	Elevation Motor Online true = Elevation Motor Online false = Elevation Motor Offline
az_motor_error	Azimuth Motor Communications Error true = Error has occurred in last minute false = No error has occurred over last minute
el_motor_error	Elevation Motor Communications Error true = Error has occurred in last minute false = No error has occurred over last minute
az_motor_fatal	Fatal Azimuth Motor Error true = A fatal motor error has occurred false = No fatal motor error has occurred
el_motor_fatal	Fatal Elevation Motor Error true = A fatal motor error has occurred false = No fatal motor error has occurred

RETURN VALUE
0 ok

COMMAND
el_offset

DESCRIPTION
Sets the antenna elevation alignment offset value

ARGUMENTS
angle Elevation Offset Angle (0 – 359.9)

RETURN VALUE
0 ok

COMMAND
ka

DESCRIPTION
Keep alive. The keep alive command must be issued at minimum interval of 30 seconds to keep the system operational.

ARGUMENTS
NONE

RETURN VALUE
0 ok

COMMAND
mod_pwr

DESCRIPTION
Controls the modulator power

ARGUMENTS
on 0 = off
1 = on

EXAMPLE
mod_pwr 1
mod_pwr 0

RETURN VALUE
0 ok

COMMAND
point

DESCRIPTION
Puts the antenna into point mode

ARGUMENTS
azimuth
elevation

EXAMPLE
point 90.0 45.5

RETURN VALUE
0 ok

COMMAND
ppi

DESCRIPTION
Puts the antenna into PPI mode

ARGUMENTS

elevation	
velocity	Azimuth velocity in degrees per second (1 – 36)
ccw	0 = Clockwise 1 = Counter clockwise

EXAMPLE
ppi 5.0 6 1

This would perform a PPI scan at 5.0º elevation with a velocity of 6º per second and counter clockwise rotation.

RETURN VALUE
0 ok

COMMAND
pwid

DESCRIPTION
Sets pulse width index used in local mode

ARGUMENTS

index	0 = 0.4 µs
	1 = 0.8 µs
	2 = 1.0 µs
	3 = 2.0 µs

EXAMPLE
pwid 0
pwid 1
pwid 2
pwid 3

RETURN VALUE
0 ok

COMMAND
radiate

DESCRIPTION
Controls transmitter radiation

ARGUMENTS

on	0 = off
	1 = on

EXAMPLE
radiate 1
radiate 0

RETURN VALUE
0 ok

COMMAND
rf_sw_mode

DESCRIPTION
Control the operating mode of the SidPol RF switch

ARGUMENTS

mode 0 = Simultaneous ZDR
1 = Vertical LDR
2 = Horizontal LDR

RETURN VALUE
0 ok

COMMAND

rhi

DESCRIPTION

Puts the antenna into RHI mode

ARGUMENTS

azimuth
0 Reserved argument must be zero
elevation Top elevation
Rserved argument must be zero

EXAMPLE

rhi 180.0 0 60.0 0

This would perform an RHI scan at 180.0º azimuth with a top elevation of 60.0º

RETURN VALUE
0 ok

COMMAND

servo_pwr

DESCRIPTION

Controls the servo power

ARGUMENTS

on 0 = off
1 = on

EXAMPLE

servo_pwr 1
servo_pwr 0

RETURN VALUE
0 ok

COMMAND
el_mode

DESCRIPTION
Sets the elevation mode

ARGUMENTS
mode 0 = point
1 = scan

RETURN VALUE
0 ok

COMMAND
el_speed

DESCRIPTION
Sets the speed of elevation movements

ARGUMENTS
speed 0 - 18

RETURN VALUE
0 ok

COMMAND
el_direction

DESCRIPTION
Sets the direction of the elevation drive when in scan mode

ARGUMENTS
0 = up
1 = down

RETURN VALUE
0 ok

COMMAND
el_position

DESCRIPTION
Sets the position angle of elevation

ARGUMENTS
el 0 – 359.9

RETURN VALUE
0 ok

COMMAND
az_mode

DESCRIPTION
Sets the azimuth mode

ARGUMENTS
mode 0 = point
1 = scan

RETURN VALUE
0 ok

COMMAND
az_speed

DESCRIPTION
Sets the speed of azimuth movements

ARGUMENTS
speed 0 - 36

RETURN VALUE
0 ok

COMMAND
az_direction

DESCRIPTION
Sets the direction of the azimuth drive when in scan mode

ARGUMENTS
0 = cw
1 = ccw

RETURN VALUE
0 ok

COMMAND
az_position

DESCRIPTION
Sets the position angle of azimuth

ARGUMENTS
az 0 – 359.9

RETURN VALUE
0 ok

COMMAND
reset

DESCRIPTION
Resets the CPU

ARGUMENTS
none

RETURN VALUE
none
