

# HyPerformance Plasma System

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## Serial Interface Protocol And CNC Signal Listing

## Revision History

Revision	Date	Description
N	07.01.2008	Release of HPR400 <ul style="list-style-type: none"><li>- Command ID 095 accepts up to 400 amps</li><li>- Table VI – Gas Type Code: Gas type #7 changed from CO2 to Argon</li><li>- Command ID 114 added inputs for HPR400 choppers signals</li><li>- Command ID 133 added analog values for HPR400 choppers (current, temperature)</li><li>- Command ID 134 added error code log for last 4 errors since system power up</li><li>- Command ID 135 added for production CAN test fixture</li><li>- Command ID 000 added "HYPERFORMANCE400XD" as a system identity.</li><li>- New Error codes:<ul style="list-style-type: none"><li>028 Lost Current Chopper 3</li><li>034 Lost Current Chopper 4</li><li>073 Chopper 3 Overtemp</li><li>074 Chopper 4 Overtemp</li><li>075 LEM 3 Current Low</li><li>076 LEM 4 Current Low</li><li>095 LEM 4 Current High</li><li>107 LEM 3 Current High</li><li>146 Chopper 3 Overtemp at Init</li><li>147 Chopper 4 Overtemp at Init</li><li>154 Chopper 3 Over current</li><li>155 Chopper 4 Over current</li><li>157 Chopper 3 Current at Init</li><li>158 Chopper 4 Current at Init</li><li>159 Motor Drive Fault</li><li>160 HPR Cooler CAN Fault</li></ul></li></ul>
M	11.10.2009	Added serial command ID #136, to enable a serial response delay time. See serial interface guidelines.

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## I) Interface Hardware

- i. The interface will use a combination of discrete signals and an RS422 interface.

## II) Signal List

### a. HPR Signals

Signal Name	Type	Description
Plasma Start	Input	When active the plasma system will fire an arc
Machine Motion 1	Output	Indicates the arc has transferred to the plate. This signal is selected using jumper on power supply control board. Only 1 motion signal is needed per system. The remaining motion signals can be used to daisy chain wire multiple systems.
Machine Motion 2	Output	Indicates the arc has transferred to the plate. This signal is selected using jumper on power supply control board. Only 1 motion signal is needed per system. The remaining motion signals can be used to daisy chain wire multiple systems.
Machine Motion 3	Output	Indicates the arc has transferred to the plate. This signal is selected using jumper on power supply control board. Only 1 motion signal is needed per system. The remaining motion signals can be used to daisy chain wire multiple systems.
Machine Motion 4	Output	Indicates the arc has transferred to the plate. This signal is selected using jumper on power supply control board. Only 1 motion signal is needed per system. The remaining motion signals can be used to daisy chain wire multiple systems.
Hold Ignition	Input	When active system will stay in preflow and delay torch ignition. This signal should be applied the same time the start signal is applied.
System Error	Output	Indicates that an error has occurred in the plasma system. Use the serial interface to query for the specific error code number.
Pierce Complete	Input	When active the system will use shield preflow gases during piercing. When the signal is removed, it will switch to shield cutflow gases. This signal should be applied at the same time the start signal is applied.
Corner Current	Input	When active the system will switch to user specified corner current.
Remote Power	Input	This signal is used to turn the power on or off
Not Ready For Start	Output	When active, this signal indicates that the plasma system is not ready for a plasma start signal. This could be because the system is purging or in test gas mode.
Rampdown error	Output	Indicates the arc did not rampdown properly. Consumable life is affected.
TX+	Serial	Transmitting from the system.

		<b>Connect to CNC RX+</b>
TX-	Serial	Transmitting from the system. <b>Connect to CNC RX-</b>
RX+	Serial	Receiving by the system. <b>Connect to CNC TX+</b>
RX-	Serial	Receiving by the system. <b>Connect to CNC TX-</b>

## b. MaxPro200 Signals

Plasma Start	Input	When active (and the hold signal is inactive) the plasma system will fire an arc. Close contact between J6 pin 1 and pin 2 on the control board
Machine Motion	Output	Indicates the arc has transferred to the plate.
Hold Ignition	Input/Output	When active system will stay in preflow and delay torch ignition. This signal should be applied the same time the start signal is applied.  <u>For installations with multiple MaxPro200 plasma systems</u> , the hold signals should be parallel on all systems. For example, connect the Hold+ signal from system #1 to system #2, then connect the Hold- signal from system #1 to system #2. This will ensure that both systems will fire together.
System Error	Output	Indicates that an error has occurred in the plasma system. Use the serial interface to query for the specific error code number.

## c. Hardware

Inputs – active low, dry contact, opto-isolated

Inactive: 24V or open circuit, 0 mA

Active: 0v or closed contact (0 ohm min, 6.5 mA; 200K ohm max, 0.1 mA)

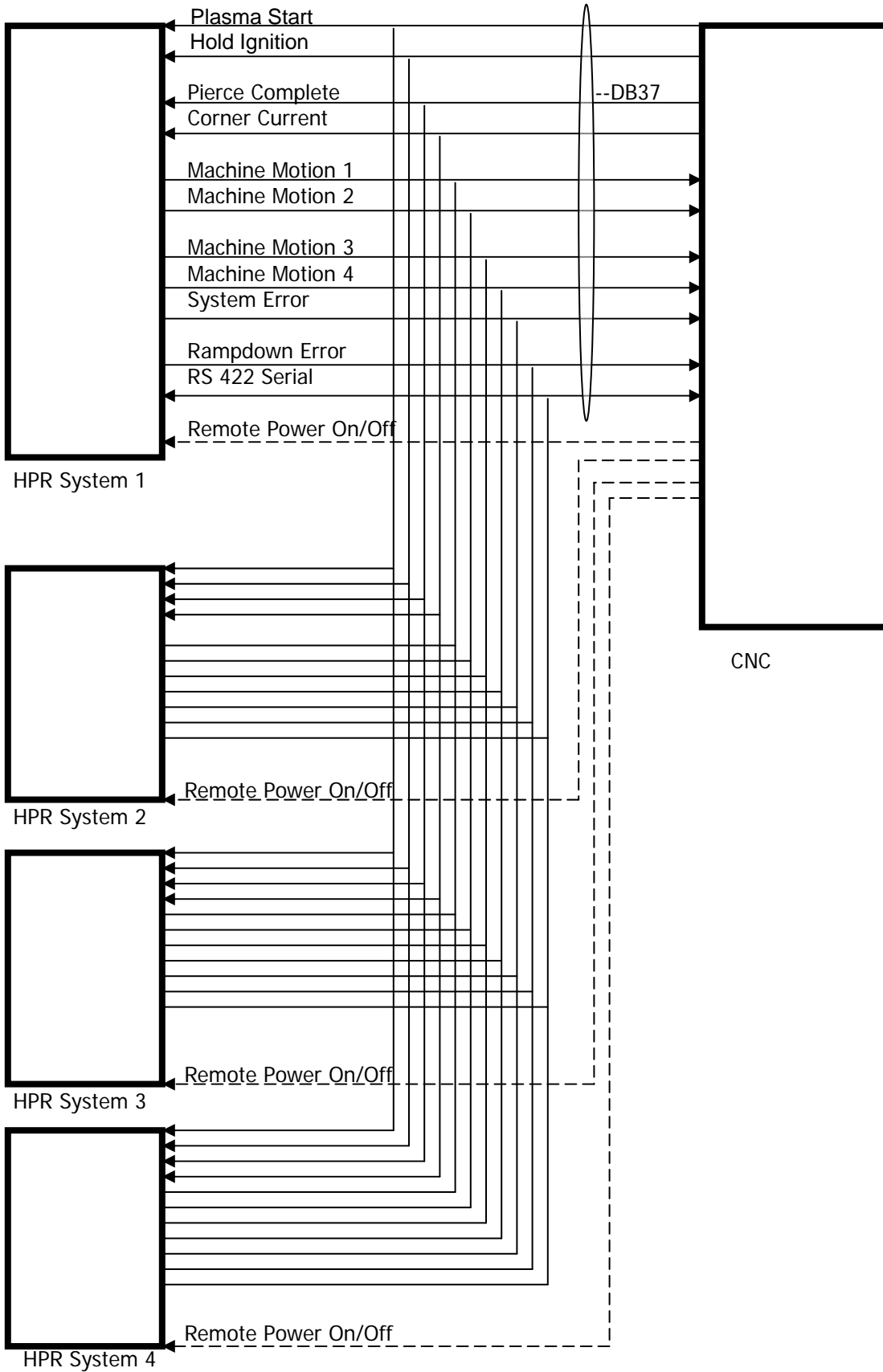
Outputs – active low, open collector, opto-isolated

Inactive: Up to 40v open circuit/open collector, 0 mA  
Recommended 24v pull-up into high impedance load

Active: 0.3v max output into high impedance load, sinking cap up to 5 mA  
Or 2k ohm min. load resistance

Serial – RS422 serial communications

## d. HPR Multi-Drop Wiring



## **e. HPR Multi-drop Addressing**

The power supply control has dipswitches to set the power supply ID. Dipswitch 2,3,4 are used to set the ID.

<u>2</u>	<u>3</u>	<u>4</u>	ID
Off	Off	Off	0
On	Off	Off	1
Off	On	Off	2
On	On	Off	3
Off	Off	On	Reserved
On	Off	On	Reserved
Off	On	On	Reserved
On	On	On	Reserved

Systems with ID 0 power up with the serial interface enabled. Systems with any other ID power up with the serial interface disabled.

To implement the multi-drop interface the CNC must send the SLEEP command (086) which will put all systems on the line into sleep mode. The WAKE command (085) with specific system ID will wake the system the CNC wants to communicate with. Any command can now be sent to that power supply, all other systems will ignore the communications. When the CNC is finished communicating with that power supply the SLEEP command must be sent, then the WAKE command is used to talk with the next system.

## **III) Serial Commands**

### **a. Format**

- ASCII based protocol
- Baud 19200
- 8 Data bits
- 1 Stop bit
- No parity
- No flow control

### **b. Framing**

- > = Start of message
- 3 byte command ID
- Data
- 2 byte checksum
- < = End of message

Sample: >0011C2<

### **c. Commands**

Responses will echo the ID of the command, unless there is an error in the command.

## Command Table

ID	Command	System	Description
000	<b>HELLO</b>	Manual Gas System Auto Gas System MaxPro200	Establish communications with the plasma system. Use this command to identify which system you are talking to.  <u>Data:</u> None  <u>Return Value:</u> String identifying the system  <u>Sample:</u> >00090< >000HYPERPERFORMANCE130MANUALB5< or >000HYPERPERFORMANCE130AUTO30< or >000HYPERPERFORMANCE130AUTOMIX1E< or >000MaxPro20079<
001	<b>VERSION</b>	Manual Gas System Auto Gas System MaxPro200	Get the version of the power supply firmware  <u>Data:</u> None  <u>Returned Value:</u> Power supply firmware then Gas console firmware, space delimited  <u>Sample:</u> >00191< >001A.0 A.25< (ps rev A, gas rev A)
002	<b>GET_STATE</b>	Manual Gas System Auto Gas System MaxPro200	Get the current state of the plasma system.  <u>Data:</u> None  <u>Return Value:</u> Status code (see table V)  <u>Sample:</u> >00292< >002000052< (status code 0)
003	<b>CURRENT_ERROR</b>	Manual Gas System Auto Gas System MaxPro200	Get the current system error.  <u>Data:</u> None  <u>Return Value:</u> Error code (see table IV)  <u>Sample:</u> >00393< >00301165B< (error code 116)



ID	Command	System	Description
004	<b>REMOTE_MODE</b>	Manual Gas System Auto Gas System MaxPro200	Switch system into remote mode, to allow remote control of the plasma system.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted, 0 = not accepted  <u>Sample:</u> >00494< >0041C5<
028	<b>READ_PLASMA_AMPS</b>	Manual Gas System Auto Gas System	Read actual power supply current  <u>Data:</u> None  <u>Return value:</u> Power supply current in amps  <u>Sample:</u> >0289A< >02801305E< (130 amps)
058	<b>SET_NOMINAL_AMPS</b>	Auto Gas System MaxPro200	Set the power supply current in amps.  Same for HPR and MaxPro200  <u>Data:</u> 5-400 Amps (Limited to 130 amps on the HPR130, and 260 on the HPR260, and 200 amps on the MaxPro200)  <u>Return value:</u> Actual current value set  <u>Sample:</u> >05813031< >058013061< (set 130 amps)
064	<b>GAS_PREFLOW_TEST_START</b>	Manual Gas System Auto Gas System	Turn on the preflow gases. Not allowed when cutting.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted, 0 = not accepted  <u>Sample:</u> >0649A< >0641CB<

ID	Command	System	Description
065	<b>GAS_PREFLOW_TEST_STOP</b>	Manual Gas System Auto Gas System	Turn off the preflow gases. Not allowed when cutting.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted, 0 = not accepted  <u>Sample:</u> >0659B< >0651CC<
066	<b>GAS_CUTFLOW_TEST_START</b>	Manual Gas System Auto Gas System	Turn on the cutflow gases. Not allowed when cutting.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted, 0 = not accepted  <u>Sample:</u> >0669C< >0661CD<
067	<b>GAS_CUTFLOW_TEST_STOP</b>	Manual Gas System Auto Gas System	Turn off the cutflow gases. Not allowed when cutting.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted, 0 = not accepted  <u>Sample:</u> >0679D< >0671CE<
068	<b>SOFTWARE_RESET</b>	Manual Gas System Auto Gas System MaxPro200	HPR: Clear error conditions and resume operation. Only accepted if system is in a shutdown error condition (Error code > 79 and State = 14).  MaxPro200: This command is only valid when the system is <u>not</u> cutting. This command will clear all errors and reset the system to the power up state and resume error checking.  <i>This command is not intended to stop plasma cutting and is not active when the arc is on.</i>  <u>Data:</u> None  <u>Return value:</u> 1 = accepted, 0 = not accepted  <u>Sample:</u> >0689E< >0681CF<

ID	Command	System	Description
070	<b>SET_CORNER_CURRENT</b>	Manual Gas System Auto Gas System	<p>When CORNER CURRENT input is activated the power supply will switch to the current percentage specified.</p> <p><u>Data:</u> % of cutting current (50-100%) 50=50%</p> <p><u>Return value:</u> % achieved</p> <p><u>Sample:</u> &gt;0707503&lt; &gt;070007563&lt; (set 75%)</p>
071	<b>MANUAL_PUMP_CONTROL</b>	Manual Gas System Auto Gas System	<p>Used to override software control of the coolant pump. If the system has a fatal error the pump cannot be overridden.</p> <p><u>Data:</u> 1 = override software to force pump on, 0 = system software controls the pump, override off</p> <p><u>Return value:</u> 1 = accepted, 0 = not accepted</p> <p><u>Sample:</u> &gt;0711C9&lt; &gt;0711C9&lt;</p>
072	<b>GET_CONTROL_VOLTAGE</b>	Manual Gas System Auto Gas System	<p>Returns the internal control voltage of the power supply</p> <p><u>Data:</u> None</p> <p><u>Return value:</u> Voltage (1/10 volts) 1200 = 120.0 volts</p> <p><u>Sample:</u> &gt;07299&lt; &gt;07212005C&lt; (120.0 volts)</p>
074	<b>GET_IO_STATUS</b>	Manual Gas System Auto Gas System	<p>Read the status of the IO ports of the DSP. Refer to IO listing for description of each bit in Ports A-F.</p> <p><u>Data:</u> None</p> <p><u>Return value:</u> PA00000000 PB00000000 PC00000000 PD00000000 PE00000000 PF00000000 Ports A-F are returned space delimited. The numbers are the decimal representation of the binary value of the port. 1 = on, 0 = off.</p> <p><u>Sample:</u> &gt;0749B&lt; &gt;074PA00000100 PB00000000 PC00010101 PD00100000 PE00010000 PF10000000B7&lt;</p>

ID	Command	System	Description
078	<b>SET_ALL_GAS_FLOWS</b>	Auto Gas System MaxPro200	<p>Set all gas flow rates.</p> <p>N2 mix setpoint and Gas 2 mix setpoint are only applicable when using a mixed plasma gas such as H35 – N2 otherwise these 2 values should be set to 0.</p> <p>A value of 0 for N2 Mix Setpoint will cause the system to close sv12, the solenoid valve for N2 mixing. A value of 0 for Gas 2 Mix Setpoint will cause the system to close sv13 and open sv14. This will cause the inlet gas to bypass motor valve 2 and pass directly to the outlet of the mixing console.</p> <p><b>HPR</b></p> <p><u>Data (space delimited):</u> Space delimited: Plasma cutflow setpoint (0 –99 psi), Plasma preflow setpoint (0 – 99 psi), Shield cutflow setpoint (0 – 99 psi), Shield preflow setpoint (0 – 99 psi), N2 Mix Setpoint (0 – 100 psi), Gas2 Mix Setpoint (0 – 100 psi).</p> <p><u>Returned value:</u> 1 = accepted, 0 = not accepted</p> <p><b>MaxPro</b></p> <p><u>Data (space delimited):</u> Plasma Pressure Setpoint (“0050”) Shield Pressure Setpoint (“0058”)</p> <p><u>Sample:</u> &gt;07855 45 35 25 50 50AB&lt; &gt;0781D0&lt;</p>

ID	Command	System	Description
079	<b>GET_PS_INFO</b>	Manual Gas System Auto Gas System MaxPro200	<p>Returns pressures, system state, and system error, space delimited</p> <p><u>Data:</u> None</p> <p><u>HPR Return value:</u>            Plasma Cutflow Pressure (0044 = 44psi)            Plasma Preflow Pressure (0044 = 44psi)            Shield Cutflow Pressure (0044 = 44psi)            Shield Preflow Pressure (0044 = 44psi)            Current Setpoint (amps)            System State (see table V) (0003 = state 3)            System Error (see table IV) (0000 = error 0)            Cut Gas 1 Pressure (0044 = 44psi)            Cut Gas 2 Pressure (0044 = 44psi)            N2 Mix Inlet Pressure (0044 = 44psi)            Gas2 Mix Inlet Pressure (0044 = 44psi)</p> <p>Note: Cut gas 1, Cut gas 2, N2 mix Inlet, and Gas 2 mix Inlet are not measured in the Manual gas console configuration.</p> <p><u>MaxPro200 Return value:</u>            System State (see table V) ("st0003")            System Error (see table IV) ("er0000")            Plasma Gas Type Code (see table VI) ("pg0001")            Plasma Pressure Setpoint ("ps0056")            Shield Gas Type Code (see table VI) ("sg0001")            Shield Pressure Setpoint ("ss0058")            Current Setpoint ("cs0200")            Display Mode("dm0001")                0=Current                1=Error/Status                2=Coolant flow                3=Test Mode            Lock Mode("lm0001") 1=display is locked, 0=unlocked</p> <p><u>Sample:</u>            &gt;079A0&lt;            &gt;079PC0044 PP0042 SC0034 SP0035 CS0040            ST0003 ER0000 CG0000 CG0000 MV0000            MV0000DE&lt;</p> <p>*****            *****</p> <p><b>For Factory Testing Only</b>            *****            *****</p> <p>Auto Gas Control Board            N2M – N2 Mix Setpoint (psi)            G2M – Gas 2 Mix Setpoint (psi)            ST - System state (state code)            ER – System Error (error code)            P1P5 – Pressure input (psi)            P2P6 – Pressure input (psi)</p> <p>-----            Split command  <b>GET_INFO2 (ID#126)</b></p>

ID	Command	System	Description
084	<b>DOWNLOAD_SOFTWARE</b>  <i>Not currently implemented on the HD4070 or the HPR systems</i>	TBD	Download new firmware to the plasma system.  <u>Data:</u> TBD  <u>Return value:</u> 1 = packet accepted, 0 = not accepted  <u>Sample:</u> TBD
085	<b>WAKE</b>	Manual Gas System Auto Gas System	This command is used to wake a system and enable its transmitter to talk on a multi drop line.  <u>Data:</u> System ID, which is set by dipswitches on PC board.  <u>Return value:</u> Echo of the command  <u>Sample:</u> >0850CD< >0850CD<
086	<b>SLEEP</b>	Manual Gas System Auto Gas System	Tell all systems on the line to disconnect their transmitters  <u>Data:</u> None  <u>Return value:</u> None  <u>Sample:</u> >0869E< No response
087	<b>BROADCAST MODE</b>	Manual Gas System Auto Gas System	Tell all systems to listen but not respond.  <u>Data:</u> None  <u>Return value:</u> None  <u>Sample:</u> >0879F< no response

ID	Command	System	Description
094	<b>READ_GAS_PRESSURES</b>	Manual Gas System Auto Gas System	<p>Read the gas pressures.</p> <p><u>Data:</u> None</p> <p><u>Return value:</u> Plasma Cutflow Pressure (psi), Plasma Preflow Pressure (psi), Shield Cutflow Pressure (psi), Shield Preflow Pressure (psi), Cut Gas 1 Pressure (psi), Cut Gas 2 Pressure (psi), N2 Mix Inlet Pressure (psi), Gas2 Mix Inlet Pressure (psi) space delimited</p> <p>Values are in psi (0007 = 7psi)</p> <p><u>Sample:</u> &gt;0949D&lt; &gt;094PC0007 PP0036 SC0016 SP0003 CG0000 CG0000 MV0000 MV00005D&lt;</p>

ID	Command	System	Description
095	<b>SET_ALL_PARAMETERS</b>	Auto Gas System MaxPro200	<p>Set all variables to run the plasma system. <b>If inlet gases change power supply will enter the purge state. Gas type changes are not allowed when the system is cutting (state 4 – state 10).</b></p> <p><b>HPR</b> N2 mix setpoint and Gas 2 mix setpoint are only applicable when using a mixed plasma gas such as H35 – N2 otherwise these 2 values should be set to 0.</p> <p>A value of 0 for N2 Mix Setpoint will cause the system to close sv12, the solenoid valve for N2 mixing. A value of 0 for Gas 2 Mix Setpoint will cause the system to close sv13 and open sv14. This will cause the inlet gas to bypass motor valve 2 and pass directly to the outlet of the mixing console.</p> <p><u>Data:</u> Current setpoint (5 – 130/260/400 amps), corner current percent (50 - 100%), plasma gas type code (use table VI), shield gas type code (use table VI), plasma cutflow setpoint (0 – 99 psi), plasma preflow setpoint (0 – 99 psi), shield cutflow setpoint ( 0 – 99 psi), shield preflow setpoint (0 – 99 psi), N2 mix setpoint (0 – 100 psi), Gas 2 mix setpoint (0 – 100 psi), space delimited.</p> <p><u>Return value:</u> 1= accepted, 0 = not accepted</p> <p><b>MaxPro200</b> <b>** It is recommended to use command #137 to set the process for MaxPro200 systems, refer to that command for more information**</b></p> <p><u>Data:</u> Current Setpoint in amps (0-200) Plasma Gas Type Code (use table VI) Shield Gas Type Code (use table VI) Plasma Pressure Setpoint in psi (0 – 99) Shield Pressure Setpoint in psi (0 – 99)</p> <p><u>Return value:</u> 1= accepted, 2 = data invalid or system not in state #2 or #3</p> <p><u>Sample:</u> &gt;095100 75 1 6 55 45 35 25 00 0084&lt; &gt;0951CF&lt;</p>



ID	Command	System	Description
096	<b>SET_INLET_GASES</b>	Auto Gas System MaxPro200	<p>Set inlet gases for auto console. <b>If inlet gases change power supply will enter the purge state. Gas type changes are not allowed when the system is cutting (state 4 – state 10).</b></p> <p><u>Data:</u> Plasma gas type code (See table VI), Shield gas type code (See table VI), space delimited.</p> <p><u>Return value:</u> 1= accepted, 0 = not accepted</p> <p><u>Sample:</u> &gt;0961 626&lt; (Set plasma gas = O2 and set shield gas = N2) &gt;0961D0&lt;</p>
097	<b>READ_CORNER_CURRENT</b>	Manual Gas System Auto Gas System	<p>Read the corner current percentage</p> <p><u>Data:</u> None</p> <p><u>Return value:</u> Percentage</p> <p><u>Sample:</u> &gt;097A0&lt; &gt;09700756C&lt; (75%)</p>
098	<b>GET_INLET_GASES</b>	Manual Gas System Auto Gas System MaxPro200	<p>Read the inlet gas types</p> <p><u>Data:</u> None</p> <p><u>Return value:</u> Plasma gas type code (See table VI), Shield gas type code (See table VI), space delimited</p> <p>*For some marking processes using N2 or Argon as the marking gas, the system may override the shield gas type code for optimum system performance. This could include changing the shield gas type code to 9, 10, or 12. It could also include using the shield gas type code from the previous cutting process.</p> <p><u>Sample:</u> &gt;098A1&lt; &gt;0980001 000648&lt; (plasma gas = O2 and shield gas = N2)</p>

# Hypertherm

ID	Command	System	Description
099	<b>GET_GAS_FLOWS</b>	Auto Gas System	Read the gas setpoints  <u>Data:</u> None  <u>Return value:</u> Plasma cutflow setpoint (psi), Plasma preflow setpoint (psi), Shield cutflow setpoint (psi), Shield preflow setpoint (psi), N2 Mix setpoint (psi), Gas2 Mix setpoint (psi) space delimited.  (55 = 55psi)  <u>Sample:</u> >099A2< >0990055 0045 0035 0025 0050 0050EE<

ID	Command	System	Description
100	<b>GET_CONTROL_DATA</b>	HPR Manual Gas System HPR Auto Gas System MaxPro200	<p>Read internal control data:</p> <p>Chopper A used in HPR130/HPR260 Chopper B used in HPR260</p> <p><u>Data:</u> None</p> <p><u>Return value:</u> See below, space delimited.</p> <p><b>HPR</b> Return string is the same whether the system is an HPR130 or HPR260. Chopper B data can be ignored for HPR130.</p> <p>chopper A temp (raw A/D, 0 - 1023), chopper B temp (raw A/D, 0 - 1023), Line voltage (1/10 volts, 0 - 2400), 240.0 vac coolant flow (1/100 gpm, 0 - 440), 4.40 gpm coolant temp (raw A/D, 0 - 1023), transformer temp (raw A/D, 0 - 1023), chopper A current (0 - 130 amps), chopper B current (0 - 130 amps), work lead current (0 - 130/260 amps), chopper A setpoint (5 - 130 amps), chopper B setpoint (5 - 130 amps), PWM chopper A (100% = 1070), PWM chopper B (100% = 1070).</p> <p><b>MaxPro200</b> Plasma actual pressure in psi ("plap0000") Shield actual pressure in psi ("shap0000") Inlet pressure in psi ("icrp0000") Coolant temp in ADC counts ("colt0000") Chopper temp in ADC counts ("chpt0000") Channel A current in amps ("chac0000") Channel B current in amps ("chbc0000") Transformer temp in counts ("xfmr0000") Inductor A temp in ADC counts ("inat0000") Inductor B temp in ADC counts ("inbt0000") Bus Voltage in volts ("busv0000") Coolant flow in gpm("flow0100") 0100 = 1.00 gpm</p> <p><u>Sample:</u> &gt;10091&lt; &gt;100CAT0482 CBT0021 LVO0118 CFL0009 CTP0481 TTP0481 CAC0001 CBC0014 WLC0005 CAS0000 CBS0534 PWMA0000 PWMB00000B&lt;</p>

ID	Command	System	Description
101	<b>SET_IO_STATUS</b>	Manual Gas System Auto Gas System MaxPro200	<p>This command will allow the user to turn on or off each output of the processor. After sending this command, the SYSTEM_RESET command must be issued to restore the processor state. The IO are in the following order:</p> <p><u>Data:</u> 1 = On, 0 = Off for each IO point</p> <p><u>Return value:</u> 1 = accepted, 0 = not accepted</p> <p><u>HPR Power Supply</u> Pilot Arc Relay Marking Surge Relay Pilot Arc Enable Coolant Pump Motor Soft Start Enable (HPR130/260 only) CNC Error CNC Rampdown Error Igniter Contactor CNC Machine Motion CNC Not Ready For Start Spare Output Motor Drive Enable</p> <p><u>MaxPro200 Power Supply</u> CNC Machine Motion Hold Ignition Output CNC Error Contactor Torch Valve Igniter Coolant Pump Motor Pilot Arc Enable</p> <p><u>Sample:</u> &gt;101111111111111110D&lt; = All outputs on &gt;1011C3&lt;</p> <p>***** <b>Data listed below is for factory testing only</b> *****</p> <p><u>Manual Gas Console</u> Shield Cutflow (SV 16) Calibrate Bypass (SV 13) Plasma Cutflow 1 (SV 14) Rampdown Valve (SV 20) Shield Preflow (SV 17) Plasma Preflow (SV 18) Plasma Cutflow 2 (SV 19) H35 Plasma Cutflow 2 (SV 12) Spare Valve (SV 15) O2 Shield Cutflow (SV 4) Air Shield Cutflow (SV 5) N2 Shield Cutflow (SV 6) Air Preflow (SV 7)</p>

ID	Command	System	Description
101	<i>Continued</i>		<p>N2 Plasma Cutflow (SV 11)</p> <p><u>Sample:</u>            &gt;10111111111111111111111111111111111166&lt;            &gt;1011C3&lt;</p> <p><u>Auto Gas Console</u></p> <p>O2 Inlet (SV1)            Air Inlet (SV 2)            Air Inlet 2 (SV 3)            H5 Inlet (SV 4)            H35 Inlet (SV 5)            F5 Inlet (SV 6)            Burkert#1 on 50 psi (B1)            Rampdown Valve (SV 16)            Spare Out 2 (Spare)            Gas 2 No Mix (SV 14)            Gas 2 Mix (SV 13)            N2 Mix (SV 12)            N2 Inlet 2 (SV 11)            Air Inlet 3 (SV 10)            N2 Inlet (SV 9)            O2 Air Inlet (SV 8)            CH4 Inlet (SV 7)            Burkert#2 on to 50 psi (B2)            Burkert#3 on to 50 psi (B3)            Burkert#4 on to 50 psi (B4)            MV1 Open 1 = activate, 0 = deactivate            MV1 Close            MV2 Open            MV2 Close</p>

ID	Command	System	Description
102	<b>SET_GAS_IO_FROM_PS</b>	Manual Gas System Auto Gas System	<p>This command will allow the user to turn on or off each output of the processor. After sending this command, the SYSTEM_RESET command must be issued to restore the processor state. The IO are in the following order:</p> <p>*****</p> <p><b>USE CAUTION WHEN SELECTING GAS VALVES TO ENSURE FUEL AND OXIDIZERS ARE NOT MIXED TOGETHER RESULTING IN A COMBUSTIBLE MIXTURE</b></p> <p>*****</p> <p><u>Data:</u> 1 = On, 0 = Off for each IO point</p> <p><u>Return value:</u> 1 = accepted, 0 = not accepted</p> <p><u>Manual Gas Console</u></p> <ul style="list-style-type: none"> <li>Shield Cutflow (SV 16)</li> <li>Calibrate Bypass (SV 13)</li> <li>Plasma Cutflow 1 (SV 14)</li> <li>Rampdown Valve (SV 20)</li> <li>Shield Preflow (SV 17)</li> <li>Plasma Preflow (SV 18)</li> <li>Plasma Cutflow 2 (SV 19)</li> <li>H35 Plasma Cutflow 2 (SV 12)</li> <li>Spare Valve (SV 15)</li> <li>O2 Shield Cutflow (SV 4)</li> <li>Air Shield Cutflow (SV 5)</li> <li>N2 Shield Cutflow (SV 6)</li> <li>Air Preflow (SV 7)</li> <li>N2 Preflow (SV 8)</li> <li>Air Plasma Cutflow 2 (SV 9)</li> <li>Air Plasma Cutflow 1 (SV 1)</li> <li>O2 Plasma Cutflow 1 (SV 2)</li> <li>H35 Plasma Cutflow 1 (SV 3)</li> <li>O2 Plasma Cutflow 2 (SV 10)</li> <li>N2 Plasma Cutflow (SV 11)</li> </ul>

ID	Command	System	Description
102	<b>Continued</b>		<p><u>Auto Gas Console</u></p> <p>O2 Inlet (SV1)            Air Inlet (SV 2)            Air Inlet 2 (SV 3)            H5 Inlet (SV 4)            H35 Inlet (SV 5)            F5 Inlet (SV 6)            Spare Out 1 (Spare)            Rampdown Valve (SV 16)            Spare Out 2 (Spare)            Gas 2 No Mix (SV 14)            Gas 2 Mix (SV 13)            N2 Mix (SV 12)            N2 Inlet 2 (SV 11)            Air Inlet 3 (SV 10)            N2 Inlet (SV 9)            O2 Air Inlet (SV 8)            CH4 Inlet (SV 7)</p> <p><u>Sample:</u>            &gt;1021111111111111111111111111111167&lt;            &gt;1021C4&lt;</p>
103	<p><b>STOP_SENDING_CAN</b></p> <p><u>Factory testing only</u></p>	<p>Board level testing for 130/260 amp power supplies, manual gas control board, and auto gas control board</p>	<p>This command is used to instruct a CAN node(power supply control board, manual gas control board, auto gas control board) to stop sending any CAN messages.</p> <p><u>Data:</u> None</p> <p><u>Return value:</u> 1 = accepted, 0 = not accepted</p> <p><u>Sample:</u> &gt;10394&lt; &gt;1031C5&lt;</p>
104	<p><b>SEND_CAN_REGSTATE</b></p> <p><u>Factory testing only</u></p>	<p>130/260 amp power supply control board</p>	<p>This command will instruct the power supply control board to send a CAN state message to the manual gas console control board.</p> <p><u>Data:</u> None</p> <p><u>Return value:</u> 1 = accepted, 0 = not accepted</p> <p><u>Sample:</u> &gt;10495&lt; &gt;1041C6&lt;</p>

ID	Command	System	Description
105	<b>SEND_CAN_REGERROR</b> <u>Factory testing only</u>	130/260 amp power supply control board	This command will instruct the power supply control board to send a CAN error message to the manual gas console control board.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted, 0 = not accepted  <u>Sample:</u> >10596< >1051C7<
106	<b>SEND_CAN_REG1FEEDBACK</b> <u>Factory testing only</u>	130/260 amp power supply control board	This command will instruct the power supply control board to send a CAN feedback message to the manual gas console control board.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted, 0 = accepted  <u>Sample:</u> >10697< >1061C8<
107	<b>SEND_CAN_PSWATCHDOG</b> <u>Factory testing only</u>	Manual gas control board	This command will instruct the manual gas console control board to send a CAN watchdog message to the power supply control board.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted, 0 = not accepted  <u>Sample:</u> >10798< >1071C9<
108	<b>SEND_CAN_PSERROR</b> <u>Factory testing only</u>	Manual gas control board	This command will instruct the manual gas console control board to send a CAN error message to the power supply control board.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted, 0 = not accepted  <u>Sample:</u> >10899< >1081CA<



ID	Command	System	Description
109	<b>SEND_CAN_PSSTATE</b> <u>Factory testing only</u>	Manual gas control board	This command will instruct the manual gas console control board to send a CAN state message to the power supply control board.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted, 0 = not accepted  <u>Sample:</u> >1099A< >1091CB<
110	<b>SEND_CAN_PS1SETPOINT</b> <u>Factory testing only</u>	Manual gas control board Auto gas control board	This command will instruct the manual gas console control board to send a CAN setpoint1 message to the power supply control board.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted, 0 = not accepted  <u>Sample:</u> >11092< >1101C3<
111	<b>SEND_CAN_PS2SETPOINT</b> <u>Factory testing only</u>	Manual gas control board Auto gas control board	This command will instruct the manual gas console control board to send a CAN setpoint2 message to the power supply control board.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted  <u>Sample:</u> >11193< >1111C4<
112	<b>START_SENDING_CAN</b> <u>Factory testing only</u>	Board level testing for 130/260 amp power supplies, manual gas control board, and auto gas control board	This command is used to instruct a CAN node(power supply control board, manual gas control board, auto gas control board) to resume sending CAN messages.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted  <u>Sample:</u> >11294< >1121C5<

# Hypertherm

ID	Command	System	Description
113	<b>SEND_CAN_PSFEEDBACK</b>  <i><u>Factory testing only</u></i>	Manual gas control board	This command will instruct the manual gas console control board to send a CAN error message to the power supply control board.  <u>Data:</u> None  <u>Return value:</u> 1 = accepted  <u>Sample:</u> >11395< >1131C6<



# Hypertherm

ID	Command	System	Description
115	<b>GET_CONTROL1</b>  <u>Factory testing only</u>	Manual Gas System Auto Gas System	Read internal control data, chopper A temp (raw A/D), chopper B temp (raw A/D), Line voltage (volts), coolant flow (1/100 gpm), coolant temp (raw A/D), transformer temp (raw A/D), chopper A current (amps).  <u>Data:</u> None  <u>Return value:</u> Above info space delimited.  <u>Sample:</u> >11597< >115CAT0482 CBT0021 LVO0118 CFL0009 CTP0481 TTP0481 CAC00FF<
116	<b>GET_CONTROL2</b>  <u>Factory testing only</u>	Manual Gas System Auto Gas System	Read internal control data, chopper B current (amps), work lead current (amps), chopper1 setpoint (amps), chopper 2 setpoint (amps), PWM chopper A (100% = 1070), PWM chopper B (100% = 1070), Pressure A (raw A/D), Pressure B (raw A/D). <i>chopper C temp (raw A/D), chopper D temp (raw A/D), chopper C current (amps), chopper D current (amps).</i>  <u>Data:</u> None  <u>Return value:</u> Above info space delimited.  <u>Sample:</u> >11698< >116CBC0014 WLC0005 CAS0000 CBS0534 PWMA0000 PWMB0000 PRSA0000 PRSB000041<

ID	Command	System	Description
117	<b><i>READ_GAS_INPUTS_FROM_PS</i></b>	Manual Gas System Auto Gas System	<p>This command will allow the CNC to query the gas console IO by sending the command to the serial port on the power supply control board.</p> <p><u>Data:</u> None</p> <p><u>Return value:</u> 1 = on, 0 = off</p> <p><u>Manual Gas Console</u> Error select Status select Test preflow Test cutflow Serial ID Bit 0 Serial ID Bit 1 Serial ID Bit 2</p> <p><u>Auto Gas Console</u> Metering dipswitch 2 Metering dipswitch 3 Metering dipswitch 4 Select dipswitch 1 Select dipswitch 2 Select dipswitch 3 Select dipswitch 4 Metering dipswitch 1</p> <p><u>Sample:</u> &gt;11799&lt; &gt;1170000000E9&lt;</p>
118	<b><i>GAS_DISPLAY_TEST_MODE</i></b>  <b><i><u>Factory testing only</u></i></b>	Manual Gas System	<p>This command is for the manual gas console control board. There are 3 display modes.</p> <p><u>Data:</u> display mode Mode 0 = run Mode 1 = all displays off Mode 2 = write 0xAA to display bus Mode 3 = write 0x55 to display bus</p> <p><u>Return value:</u> 1 = accepted, 0 = not accepted</p> <p><u>Sample:</u> &gt;1180CA&lt; &gt;1181CB&lt;</p>
119	<b><i>PS_ONLY_TEST_MODE</i></b>  <b><i><u>Factory testing only</u></i></b>	Manual Gas System Auto Gas System	<p>This command will allow the power supply control board to run without a gas console connected. The power supply will ignore the CAN and will not send any CAN messages. <b>This command will force the system to ignore all interlocks. The system must never be run in this mode, it is for production testing only.</b></p>

# Hypertherm

ID	Command	System	Description
120	<b>IGNORE_ALL_INTERLOCKS</b>  <u><i>Factory testing only</i></u>	Manual Gas System Auto Gas System	This command will force the power supply to ignore all errors related to the power supply. <b>This is for production testing only, the system must never be in this mode during normal operation.</b>  RESET will not clear this condition, only re-powering the system.

ID	Command	System	Description
121	<b>LEAK_CHECK_MODE</b>	Manual Gas System Auto Gas System	<p>This command will put the system into leak mode. There are 3 modes, mode #1 is the inlet leak check mode. This is used to see if the inlet solenoids are allowing gas to pass through the valve even when they are closed.</p> <p>Mode #2 is the system leak check mode which will test for leaks to atmosphere within the system. Mode #3 is the Burkert valve flow test, this is for automatic gas consoles only.</p> <p>For the Inlet leak test the system should have 0 psi on all gas channels, and hold at this pressure.</p> <p>For the System leak test the system should charge all gas lines, then hold the pressure.</p> <p>The Burkert Flow test checks for an expected PWM value for a set pressure and does a gas rampdown test.</p> <p><b>NOTE: This test is preformed using 130 amp O2/Air consumables and setting the 30 amp O2/O2 process</b></p> <p>All tests take about 40 seconds to complete.</p> <p>This command will only be accepted when the power supply is at status IDLE2 (03)</p> <p>After leak checking is complete the system must be set to mode 0.</p> <p>An error code will reflect the state of the test. Using the GET_LAST_ERROR command, you can get the result of the test.</p> <p>12 = Test in progress 13 = Test passed 14 = Cut Gas Channel #1 failed 15 = Cut Gas Channel #2 failed 16 = Plasma Rampdown test failed (Burkert test only) 17 = Shield Rampdown test failed (Burkert test only)</p> <p><u>Data:</u> Mode 0 = run 1 = Inlet leak check 2 = System leak check 3 = Burkert flow check</p> <p><u>Return value:</u> Time for the test to run in seconds, 0 = not accepted</p> <p><u>Sample:</u> &gt;1211C5&lt; &gt;12140F8&lt; "40 second test"</p>

ID	Command	System	Description
122	<b>READ_GAS_SWITCH</b>	Manual Gas System	<p>This command will return the actual position of the rotary switches used to set the inlet gas type.</p> <p>The difference between this command and 098 is that this command returns the values set by the position of the switch. The 098 command returns values that the software decides are acceptable gas combinations. For example H35 plasma and O2 shield is not acceptable and is overridden by the software to be H35 plasma and N2 shield regardless of the position of the shield gas knob. In this case the 098 command would return H35 N2. This command will return H35 O2.</p> <p><u>Data:</u> None</p> <p><u>Return value:</u> Plasma gas type code (See table VI), Shield gas type code (See table VI), space delimited</p> <p><u>Sample:</u> &gt;12295&lt; &gt;1220001 00063C&lt;</p>
123	<b>OVERRIDE_CURRENT</b>  <b><u>Factory testing only</u></b>	Manual Gas System Auto Gas System	Override the current setting for the system.
124	<b>INDEX_MOTORVALVES</b>	Auto Gas Console	<p>Move the motor valve by a fixed number of ADC counts</p> <p><u>Data:</u> Motor Valve number (1 or 2) Open/Closed (0 = Close, 1 = Open) Multiplier (move by x10 counts, 3 = move 30 counts)</p> <p><u>Return value:</u> 1 = accepted</p> <p><u>Sample:</u> Open Motor valve 1 by 30 counts &gt;1241 1 36C&lt; &gt;1241C8&lt;</p>



ID	Command	System	Description
125	<b>GET_TIMER_COUNTER</b>	Manual Gas System Auto Gas System	Read Timer/Counter data from the power supply  <u>Data:</u> None  <u>Return value:</u> Arc On Time (Seconds) System On Time (Minutes) Total Starts (# of arc transfers) Total Starting Errors (Failed to transfer) Total Rampdown Errors (failed to rampdown current) Write Counter (# of writes to the current memory block – for diagnostics only) Memory Block (Current memory location for timer counter data – for diagnostics only)  All fields are a fixed width of 7 numbers followed by a space.  <u>Sample:</u> >12598< >1250000000 0000000 0000000 0000000 0000000 0000000 0000000 58<
126	<b>GET_INFO2</b>	Auto Gas Control Board only	See 079
127	<b>GET_INFO3</b>	Auto Gas Control Board only	See 079
128	<b>SEND AUTO GAS CAN MESSAGE</b>  <i><u>Factory testing only</u></i>	Auto Gas Control Board only	FOR FACTORY USE ONLY  Send a remote CAN frame to the selection console.
129	<b>MOTOR VAVLES IN MAINT</b>  <i><u>Factory testing only</u></i>	Auto Gas Control Board only	FOR FACTORY USE ONLY  1 = No closed loop motor valve control 0 = closed loop control of motor valve based on position feedback
130	<b>SEND METERING CAN MESSAGE</b>  <i><u>Factory testing only</u></i>	Auto Gas Control Board only	FOR FACTORY USE ONLY  Send a remote CAN frame to the metering console.
131	<b>CLEAR WARNINGS</b>	Manual Gas System Auto Gas System	This Command will clear error codes less than #43.  <u>Sample:</u> >13195< >1311C6<
132	<b>READ COOLANT PRESSURE</b>	HPR260 ONLY	This command returns the raw A/D value for coolant pressure.  83 counts = 225 psi 73 counts = 200 psi  <u>Sample:</u> >13296< >13280FE<

ID	Command	System	Description
133	<b>GET CONTROL DATA3</b>	HPR400	<p>This command provides data for the 3<sup>rd</sup> and 4<sup>th</sup> choppers used in the HPR400 system.</p> <p>chopper C temp (raw A/D)  chopper D temp (raw A/D)  chopper C current (amps)  chopper D current (amps)</p> <p><u>Data:</u>  None</p> <p><u>Return value:</u>  Above info space delimited.</p> <p><u>Sample:</u>  &gt;13397&lt;  &gt;133CCT0482 CDT0021 CCC0000 CDC000050&lt;</p>
134	<b>READ ERROR LOG</b>	All HPR Systems	<p>This command will return the last 4 error codes the system encountered. The log will only record errors (error code values greater than 0). It ignores error code 0, which indicates no error or that an error has been cleared.</p> <p>The error codes are listed space delimited, most recent error first.</p> <p><u>Data:</u>  None</p> <p><u>Return value:</u>  Error – most recent (see table IV Error Codes)  Error #2  Error #3  Error – oldest error</p> <p><u>Sample:</u>  &gt;13498&lt;  &gt;134020 020 024 0534A&lt;</p>
135	<b>CAN LOOPBACK TEST</b> <u>Factory testing only</u>	HPR400 only	<p>This command will run a loopback test on the manufacturing loopback fixture.</p> <p><u>Sample:</u>  &gt;13599&lt;  &gt;1351CA&lt;</p>

ID	Command	System	Description
136	<b>SERIAL RESPONSE DELAY</b>	HPR130XD/260XD	<p>This command adds approximately 1 millisecond to the response time of any serial command. This was implemented as a simple delay loop before the serial response is transmitted by the HPR system.</p> <p>1 = Enable delay 0 = Disable delay</p> <p><u>Sample:</u> &gt;1360CA&lt; //disable the delay &gt;1361CB&lt;</p> <p>&gt;1361CB&lt; //enable the delay &gt;1361CB&lt;</p>
137	<b>SET PROCESS</b>	MaxPro200	<p>This command will set the process current and gas types. <b>With this information the plasma system will automatically set all system parameters, including the gas pressures. The system will also adjust the gas pressure settings based on lead length. If the pressure setpoints are changed using commands #095 or #078, the lead length offsets will not be applied by the plasma system.</b> This command is only accepted when the system is in state #2 or #3.</p> <p><u>Data:</u> Current setpoint (5 – 200 amps), plasma gas type code (use table VI), shield gas type code (use table VI),</p> <p><u>Return value:</u> 1= accepted 2 = not accepted, data invalid, or system not in state 2 or 3</p> <p><u>Sample:</u> &gt;137200 5 5D7&lt; &gt;1371CC&lt;</p>
138	<b>IS SYSTEM READY FOR START</b>	MaxPro200	<p>This command will indicate if the plasma system is ready to receive a start signal.</p> <p>1=ready 0=not ready</p> <p><u>Sample:</u> &gt;1389C&lt; &gt;1380CC&lt; //system is not ready</p>

ID	Command	System	Description
139	<b>SET MFG TEST MODE</b>	MaxPro200	This command will set the test mode.  0 = No Test Selected 1 = Chopper Power up Test 2 = Pilot Arc Test 3 = Full Power Test 4 = Test Complete  <u>Sample:</u> >1399D< >1390CD<
140	<b>GET MFG TEST MODE</b>	MaxPro200	This command will get the test mode.  0 = No Test Selected 1 = Chopper Power up Test 2 = Pilot Arc Test 3 = Full Power Test 4 = Test Complete  <u>Sample:</u> >14095< >1400C5<
141	<b>GET MFG DATA1</b>	MaxPro200	See command ID #100  Plasma actual pressure in psi ("plap0000") Shield actual pressure in psi ("shap0000") Inlet pressure in ADC counts ("icrp0000") Coolant temp in ADC counts ("colt0000") Chopper temp in ADC counts ("chpt0000") Channel A current in amps ("chac0000")  Command #ID 100 was split into 2 parts (ID# 141,142) to reduce the length of the #100 command.
142	<b>GET MFG DATA2</b>	MaxPro200	See command ID #100  Channel B current in amps ("chbc0000") Transformer temp in counts ("xfmr0000") Inductor A temp in ADC counts ("inat0000") Inductor B temp in ADC counts ("inbt0000") Bus Voltage in volts ("busv0000") Coolant flow in gpm("flow0100")  Command #ID 100 was split into 2 parts (ID# 141,142) to reduce the length of the #100 command.
143	<b>SET TEST MODE</b>	MaxPro200	When the system is in state #3 – Ready for Start, this command will activate one of the test modes.  <u>Test Modes:</u> 0 <b>No test.</b> Gases will stop flowing if the system was previously in another test mode. 1 <b>Test Gas,</b> plasma and shield gases flow at set value.

ID	Command	System	Description
			<p>2 Local display will show software rev.</p> <p>3 <b>Plasma leak check</b> – The plasma channel will be pressurized then the pressure trapped. Local display will show actual pressures. The system will remain in this state until commanded to another test. The pressure in the plasma channel is expected to remain within 2 psi for a period of 5 minutes. The shield gas channel is expected to drop to near 0 psi.</p> <p>4 <b>Test Gas Full Pressure</b>, plasma and shield gases flow at full pressure. Low pressure errors will be typical in this mode as the system is attempting to achieve the maximum flow possible.</p> <p>5 Local display will show the torch ID.</p> <p>6 <b>In-line valve test.</b> The plasma channel will briefly pressurize, then the system will close the burkert valve and open the in-line torch valve. The plasma pressure is expected to drop to near 0 psi (less than 5 psi), in less than 30 seconds.</p> <p>Use the system reset command to leave test mode.</p> <p><u>Sample:</u> &gt;1431C9&lt; //request test mode 1 &gt;1431C9&lt;</p>
144	<b>SET MAINTENANCE MODE</b>	MaxPro200	<p>This command will send the system into maintenance mode. This mode is used for the Set IO Status serial command. In this mode the system will update the IO points. As well it will update the torch ID input values.</p> <p>Use the software reset command to leave maintenance mode.</p> <p>This command is not active while the arc is on.</p> <p><u>Sample:</u> &gt;14499&lt; //go to maintenance mode &gt;1441CA&lt;</p>

ID	Command	System	Description
145	<b>READ TORCH ID</b>	MaxPro200	<p>This command will return the torch ID.</p> <p>0 = No jumper detected            1 = 100 Ft mechanized torch            2 = 25 Ft mechanized torch            3 = 75 Ft mechanized torch            4 = 100 Ft hand torch            5 = reserved            6 = 50 Ft mechanized torch            7 = reserved            8 = 25 Ft hand torch            9 = 50 Ft hand torch            10 = reserved            11 = reserved            12 = 75 Ft hand torch</p> <p><u>Sample:</u>            &gt;1459A&lt;            &gt;14500025C&lt; //id = 2</p>
146	<b>FRONT PANEL LED TEST</b>	MaxPro200	<p>When the system is in Maintenance mode, the system will turn on or off all the LEDs on the front panel display.</p> <p>1 = LEDs on            0 = LEDs off</p> <p><u>Sample:</u>            &gt;1461CC&lt; //turn on all LEDs            &gt;1461CC&lt;</p>
147	<b>SET REDCART MODE</b>	MaxPro200	<p>This command is similar to maintenance mode (id #144) except the user interface is still enabled.</p> <p>.</p> <p><u>Sample:</u>            &gt;1479C&lt;            &gt;1471CD&lt;</p>

### d. Error Responses

If there is a problem with the serial command the module will return an error.

#### *Bad Checksum*

Return ID: 500

Description: The serial command received does not have the correct checksum.

Sample: >00091< - checksum should be 90 not 91

>50095< - bad checksum

## Bad Command

Return ID: 501

Description: If the module does not recognize the command ID it will return ID 501.

Sample >999AB< - unknown ID

>50196< - bad command

## e. Calculating Checksums

Checksum is calculated on the command ID and command data only.

HELLO Command: >00090<

0 = 0x30 (ASCII value for number 0)

0 = 0x30

0 = 0x30

-----

checksum = 0x30 + 0x30 + 0x30 = 90

READ INPUTS power supply response: >107000058<

1 = 0x31

0 = 0x30

7 = 0x37

0 = 0x30

0 = 0x30

0 = 0x30

0 = 0x30

-----

checksum = 0x31 + 0x30 + 0x37 + 0x30 + 0x30 + 0x30 + 0x30 = 0x158

We only use the 2 least significant digits so the checksum = 58

## IV) Error Codes

ID	Name	Description
000	NO ERROR	System is ready to run
009	FLOW SWITCH TEST	When the pump is restarted after a pump timeout (30 minutes without a start signal) the system will test the flow switch to make sure there is sufficient flow before firing the torch.

012	TEST IN PROGRESS	One in the gas test modes is running
013	TEST PASSED	The test completed successfully
014	CUT GAS CHANNEL #1 FAIL	The gas pressure is dropping on channel #1, indicating a leak
015	CUT GAS CHANNEL #2 FAIL	The gas pressure is dropping on channel #2, indicating a leak
016	PLASMA RAMPDOWN FAIL	Plasma pressure did not decrease in the allotted time
017	SHIELD RAMPDOWN FAIL	Shield pressure did not decrease in the allotted time
018	PUMP OVER PRESSURE	Pump output has exceeded 200 psi
020	NO PILOT ARC	No current detected from choppers before 1-second timeout
021	NO ARC TRANSFER	No transfer signal detected before 300-msec timeout
024	LOST CURRENT CH1	After transfer lost chopper current signal
025	LOST CURRENT CH2	After transfer lost chopper current signal
026	LOST TRANSFER	After transfer lost the transfer signal
027	LOST PHASE	When main contactor is engaged no phase ok input
028	LOST CURRENT CH3	After transfer lost chopper current signal
030	GAS SYSTEM ERROR	A failure had a occurred in the gas system
031	START LOST	Start signal was removed before steady state operation
032	HOLD TIMEOUT	Hold signal was applied for longer than 60 seconds
033	PRE CHARGE TIMEOUT	Gas console was not able to charge the gas lines to the correct value
034	LOST CURRENT CH4	After transfer lost chopper current signal
042	N2 PURGE LOW PRESSURE ERROR	Low N2 gas pressure while purging because of switching from a fuel gas process to an oxidizing process or vice versa
044	LOW PLASMA GAS PRESSURE	Gas pressure under lower limit (15 psi preflow, 50 psi outflow)
045	HIGH PLASMA GAS PRESSURE	Gas pressure over upper limit (110 psi)
046	LOW LINE VOLTAGE	Line voltage is under lower limit (-15%)
047	HIGH LINE VOLTAGE	Line voltage is over upper limit (+15%)
048	CAN ERROR	An error occurred with the CAN communication system
050	START ON AT INIT	Start signal input is active during power up
053	LOW SHIELD GAS PRESSURE	Gas pressure is under lower limit (2 psi)
054	HIGH SHIELD GAS PRESSURE	Gas pressure is over upper limit (110 psi)
055	MV 1 INLET PRESSURE	Motor valve 1 inlet pressure is less than 90 psi or greater than 130 psi.
056	MV 2 INLET PRESSURE	Motor valve 2 inlet pressure is less than 90 psi or greater than 130 psi.
057	CUT GAS 1 PRESSURE	In the selection console, cut gas 1 outlet pressure is less than 90 psi or greater than 130 psi.



058	CUT GAS 2 PRESSURE	In the selection console, if cut gas 2 outlet pressure is less than 90 psi for non mixing or less than 20 psi when mixing or greater than 130 psi.
060	LOW COOLANT FLOW	Coolant flow is present but is less than the required 0.6 gpm
061	NO PLASMA GAS TYPE	Plasma gas has not been selected
062	NO SHIELD GAS TYPE	Shield gas has not been selected or system is in test mode
065	CHOPPER1 OVERTEMP	Chopper #1 overheated
066	CHOPPER2 OVERTEMP	Chopper #2 overheated
067	MAGNETICS OVERTEMP	Transformer has overheated
071	COOLANT OVERTEMP	Torch coolant has overheated
072	AUTOMATIC GAS CONTROL BOARD OVERTEMP	Control board has exceeded 90 degrees C
073	CHOPPER3 OVERTEMP	Chopper #3 overheated
074	CHOPPER4 OVERTEMP	Chopper #4 overheated
075	LEM 3 CURRENT LOW	Current is less than 10 amps during the chopper test
076	LEM 4 CURRENT LOW	Current is less than 10 amps during the chopper test
093	NO COOLANT FLOW	Coolant flow is less than 0.6 gpm or greater than 3.0 gpm
095	LEM 4 CURRENT HIGH	Current has exceeded 35 amps during chopper test
099	CHOPPER1 OVERTEMP AT INIT	Chopper #1 is indicating overtemp during powerup
100	CHOPPER2 OVERTEMP AT INIT	Chopper #2 is indicating overtemp during power up
101	MAGNETICS OVERTEMP AT INIT	Transformer is indicating overtemp during powerup
102	LEM SENSOR A FAULT	Chopper A current signal is invalid
103	LEM 1 CURRENT HIGH	Current has exceeded 35 amps during chopper test
104	LEM 2 CURRENT HIGH	Current has exceeded 35 amps during chopper test
105	LEM 1 CURRENT LOW	Current is less than 10 amps during the chopper test
106	LEM 2 CURRENT LOW	Current is less than 10 amps during the chopper test
107	LEM 3 CURRENT HIGH	Current has exceeded 35 amps during chopper test
108	TRANSFER AT INIT	The system has detected current on the work lead during power up
109	COOLANT FLOW AT INIT	Coolant flow is greater than 0.3 gpm when pump is off.
111	COOLANT OVERTEMP AT INIT	Coolant is indicating overtemp during powerup
116	WATCHDOG INTERLOCK	CAN communication error
123	MV 1 ERROR	Motor valve 1 did not move into position within 60 seconds
124	MV 2 ERROR	Motor valve 2 did not move into position within 60 seconds
133	UNKNOWN GAS CONSOLE TYPE	The power supply control board does not recognize the gas console installed or has not received a CAN message identifying the type of console installed
134	CHOPPER 1 OVERCURRENT	Chopper 1 current feedback has exceeded 160 amps
138	CHOPPER 2 OVERCURRENT	Chopper 2 current feedback has exceeded 160 amps

139	PURGE TIMEOUT ERROR	The purge cycle did not complete within 3 minutes
140	PRESSURE TRANSDUCER #1 ERROR	Selection Console – Motor Valve #1 inlet Metering Console – Plasma gas outlet
141	PRESSURE TRANSDUCER #2 ERROR	Selection Console – Motor Valve #2 inlet Metering Console – Shield gas outlet
142	PRESSURE TRANSDUCER #3 ERROR	Selection Console – Cut Gas 1 outlet Metering Console – Cut Gas 1 inlet
143	PRESSURE TRANSDUCER #4 ERROR	Selection Console – Cut Gas 2 outlet Metering Console – Cut Gas 2 inlet
144	MANUAL GAS CONSOLE INTERNAL FLASH ERROR	DSP memory is not working properly
145	AUTO GAS CONSOLE INTERNAL FLASH ERROR	DSP memory is not working properly
146	CHOPPER #3 OVERTEMP AT INIT	Chopper #3 is indicating over temp during power up
147	CHOPPER #4 OVERTEMP AT INIT	Chopper #4 is indicating over temp during power up
151	SOFTWARE FAIL	Software has detected an incorrect state or condition
152	INTERNAL FLASH ERROR	DSP memory is not working properly
153	PS EEPROM ERROR	EEPROM memory on power supply board not working
154	CHOPPER 3 OVER CURRENT	Chopper 3 current feedback has exceeded 160 amps
155	CHOPPER 4 OVER CURRENT	Chopper 4 current feedback has exceeded 160 amps
156	CHOPPER 2 CURRENT AT INIT	Chopper 2 current signal is active on powerup
157	CHOPPER 3 CURRENT AT INIT	Chopper 3 current signal is active on powerup
158	CHOPPER 4 CURRENT AT INIT	Chopper 4 current signal is active on powerup
159	MOTOR DRIVE FAULT	Motor drive board power module is indicating an alarm – This can be comparable to “blowing a fuse” – does not necessarily indicate a problem with the board.
160	HPR COOLER CAN FAULT	Communications between the control board and the pump/motor drive board was interrupted for greater than 1 second.
180	SELECTION CONSOLE CAN TIMEOUT	Power supply has not received a CAN message from the selection console within 1 second
181	METERING CONSOLE CAN TIMEOUT	Power supply has not received a CAN message from the metering console within 1 second
190	LEM SENSOR B FAULT	Chopper B current signal is invalid

## V) State Codes

ID	MaxPro State	HPR State
00	POWER UP	IDLE
01	INITIAL CHECKS	N/A
02	GAS PURGE	PURGE
03	READY FOR START	IDLE2
04	PREFLOW	PREFLOW
05	PREFLOW HOLD	PILOT ARC
06	IGNITE	TRANSFER
07	PILOT ARC	RAMPUP
08	RAMPUP	STEADY STATE
09	MAIN ARC	RAMPDOWN
10	RAMPDOWN	FINAL RAMPDOWN
11	RAMPDOWN COMPLETE	AUTO OFF
12	END OF CYCLE	TEST CUTFLOW
13	-----	-----
14	SHUTDOWN	SHUTDOWN
15	RESET	RESET
16	MAINTENANCE	MAINTENANCE
17	STANBY	-----
20		TEST PREFLOW
22	-----	MANUAL PUMP CONTROL
23	-----	INLET LEAK CHECK
24	-----	SYSTEM LEAK CHECK
25	-----	BURKERT FLOW CHECK

## VI) Gas Type Codes

ID	Gas Type	Notes
0	No Gas	Invalid gas type
1	Oxygen	
2	Methane (CH4)	
3	H35 (Argon – Hydrogen)	Use H35 as plasma gas and N2 as shield gas for H35/N2 mixed plasma gas processes
4	H5	
5	Air	
6	Nitrogen	
7	Argon	
8	N95	
9	N2 Channel 1	Internal N2 marking mode, not used by CNC
10	N2 Channel 2	Internal N2 marking mode, not used by CNC
11	F5	
12	Ar-Air	Internal Ar marking mode, not used by CNC

## VII) Serial Interface Guidelines

### 1. *Checksum*

The protocol used for the serial interface between the Hypertherm system and the CNC contains a checksum on the message being sent. The checksum should be validated for all messages to ensure the information is not corrupted.

### 2. *Message Retries*

We recommend retrying a message if the original message was not acknowledged by the system. This is especially important when the high frequency ignition is active. The high frequency ignition can be active for up to 1 second and can corrupt serial communications. It is important to space the retries so that the system can handle an interruption in serial communications for up to 1 second.

Another alternative to handling the high frequency ignition is to poll for the power supply state, using the GET\_STATE command. If the state is (5 – Pilot arc) then stop serial communications until the state is no longer (5 – Pilot arc).

### 3. *Cable Shielding*

We have chosen to use metal shell DB style machine/serial interface cables on some on the newer systems. One of the reasons this type of cable was selected is for their EMI shielding capabilities. It is important that integrity of the shielding of this cable is maintained. The shielding provides protection from the high frequency ignition system, if the cable shields are not properly terminated then the protection is not as effective. This is best achieved by ensuring the shield has a 360° termination provided on both end of the cables. Using a drain wire will not achieve the proper shielding. The cable should also be as short as possible with no coils.

### 4. *Serial response timing*

For standard HPR systems, the response to a serial command will come between 1 – 7 milliseconds after the command is received. For HPR XD systems the response time is generally reduced by 50%. For systems that require a minimum response time, serial command #136 will add 1.0 – 1.8 milliseconds to the response time of the system.

## VIII) Application Notes

1. Transmitting extra characters at the end of a message or transmitting while the plasma system is responding

The original control board 041808 and power supply control software revision H and prior can sometimes “lock up” when the power supply is receiving characters while it is transmitting. The reason for this is that the control system cannot process interrupts fast enough. In some cases, when a receive interrupt and a transmit interrupt occur very close together the system will miss one of the interrupts and will not process any more serial characters. Under normal conditions this will not be an issue. As long as you wait for a response to every command before transmitting the next command the problem will not occur. Also it is important not to include extra characters at the end of a command such as a carriage return or line feed. These are not required and can cause problems.

Power supply control software revision J improves the capability of the system and will reduce the likelihood of occurrence, however it can still happen. The new style control board 041909 has fixed the problem in hardware.