The 8200 module is a high speed limit switch module that resides in a ControlLogix rack. This module has a maximum of 32 outputs, 16 of which are physical outputs off of a relay board(s) and 16 of which are virtual outputs over the backplane. The virtual outputs will always be numbered 17 to 32. The 8200 unit has the ability to both output and receive serial data, allowing multiple units to be "slaved" together. Each output can be programmed to operate with 4 On/Off independent setpoints, as timed output, or as sequence of pulses. Timed outputs can be programmed in position or time mode. In position mode the timed output is deactivated when the position is outside the programmed setpoint window or when the programmed time has elapsed, whichever comes first. In time mode once activated with the programmed position window the output is deactivated only after the programmed time has expired. Timed outputs can have dual time dwell or pulse series. The outputs can be ANDed with an input or with a motion detector. The outputs can be forced On or forced Off from the backplane. This module also has 16 virtual, transmitted over the backplane, and 16 physical inputs. The physical inputs can be programmed to be used either high true or low true, and provide ANDing functions and group control. The module can be programmed to operate in independent mode, where each output is ANDed with its corresponding input, or group mode, where multiple outputs are controlled by one input. There is a maximum of six groups available, and they can be programmed to operate in 1 of 6 modes.

Mode 0: Outputs operating in Mode 0 function normally and are not affected by the input terminal or group channel.
Mode 1: Outputs operating in Mode 1 are always enabled to turn on at their programmed setpoints. When the group input is activated, the group's position is preset to the group's preset value. The input is ignored until the group control position is reached. The input must transition from 0 to 1 after the group control position is reached.
Mode 2: Outputs operating in Mode 2 are disabled until the group input is activated, at which time the group's position is preset to the preset value. The outputs will be active until the group control position is reached. The input is ignored until the group control position is reached. The input must transition from 0 to 1 after the group control position is reached.
Mode 3: Outputs operating in Mode 3 can be active only when the group control input is active. The group channel On/Off points are not used in mode 3.
Mode 4: Outputs operating in Mode 4 will be active for one cycle only when the group's input transitions from 0 to 1 between the group channel's On and Off points. The cycle ends when either the group channel On or Off point is reached, at which point the outputs turn off.
Mode 5: Outputs operating in Mode 5 will be active for one cycle only when the group's input is active in the range between the group channel's On and Off points. The outputs will be active only when the resolver's shaft is turning, or if the first cycle input is active. The outputs will turn off after there is no change in position for either 504ms or 120ms, depending on how the tach response parameter is set. The cycle ends when either the group channel On or Off point is reached, at which point the outputs turn off.

Note 1: The 8200 module must be configured at each power up. This includes parameters such as scale factor, offset, direction, On/Off Setpoints, etc
Note 2: The X used in the following descriptions refers to the slot number that the 8200 module is plugged into.
Note 3: All module setup parameters, Scale Factor, Offset, Preset, Direction, Tach Response, and Motion Detect are programmed with the respective LADDER MESSAGE Instruction, and are triggered by either the 0 to 1 or 1 to 0 toggling of its own transmit bit.
Note 4: There are two force functions, Force On and Force Off. Both are programmed in the output table. When a Force On bit is set, the output it represents will be activated, regardless of the output state. When a Force Off bit is set, the output is represents will be turned off, regardless of the output state. The Force Off function takes priority over the Force On function.
Note 5: The module can be programmed to operate two ways, with or without group functionality. When the groups are used, the inputs will control the groups. In Independent Mode, each output will only fire when its corresponding input is active. For example, input 1 will control output 1, input 2 will control output 2, etc. To use independent mode when there are no inputs present, set the input state to be active low. Also, when in non group mode, the outputs cannot be "enable-ANDed", however, they can be "motion-ANDed".
Note 6: The inputs to the 8200 module have a debounce time of 0, and are scanned every 1ms.
Note 7: In group mode, inputs will be acted on only if the position data is scanned between the programmed group channel's On and Off points. If the resolver position data passes through the group channel in less than 1 ms, the input may not be detected. This is most important if the groups are being used in either mode 4 or 5.
Note 8: With message instance numbers 201 and 202 only 4 physical and 4 virtual outputs can be programmed as timed outputs

Note 9: With message instance number 204, Time Mode, all 16 physical outputs can be programmed as timed outputs, each one with up to 2 time dwells. However, virtual outputs cannot be used.

Note 10: In time mode, the output must be on for at least 1ms and off for 1ms for a second timed output to fire correctly. This includes both the programmed timed value and the programmed number of resolver counts. If 2 On/Off setpoints overlap or the time between the first and the second is < 1mS, the module generates only one pulse.

Note 11: The reference voltage will be set by powering up the module with jumper JP3 installed and attaching a test MS-8P connector to the unit. This connector will have jumpers between pins 1 and 6, "+ref" to "+cos", pins 2 and 5, "-ref" to "-cos", and pins 7 and 8, "+sin" to "-sin".

Note 12: Transmit bit works on both rising and falling edges.

Note 13: All 8200 modules use a common *VENDOR ID = 10* for AMCI and *PRODUCT TYPE = 9* for resolver. The Product Codes for the existing 8213 module and possible AMCI ControlLogic modules are shown below.

PRODUCT CODES

8211-07	8211	8212	8213	8213-07	8241
6	7	8	9	10	11

Installing the 8200 module in a ControlLogix System

1. Open RSLogix 5000 and the project in which you want to install the AMCI 8200 module.
2. Right click on I/O Configuration in the Project Tree.
3. Select New Module.
4. Select the following module type and description from the list that appears.

   Type = 1756-MODULE
   Description = Generic 1756 Module

5. Click on OK.
6. Enter the following module properties.

   Name: *Your Choice* (must begin with a letter)
   Description: *Your Choice*
   Comm Format: *Data-INT* (must be Data-INT)
   Slot: *location of 8200 module*

7. Enter the Connection Parameters from the following table. Please note the different parameters for Independent and Group Mode operations, and that power must be cycled to the unit when switching between the two.

CONNECTION PARAMETERS

Simple Limit Switch (Independent Mode)		
	Assembly Instance	Size in 16 bit words
INPUT	100	7
OUTPUT	194	8
CONFIGURATION	1	0
Limit Switch with Grouping (Group Mode)		
INPUT	101	13
OUTPUT	194	8
CONFIGURATION	242	0

8. Click on Next >
9. Set the RPI (Rate Packet Interval) Time to the desired value. The minimum value for the 8200 module is 0.3ms.
10. Click on Finish >>

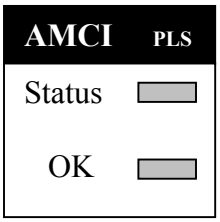
11. The module should now appear in the project tree. The Input data will be referenced as Local:X.I.Data[Y] and the output data will be referenced as Local:X.O.Data[Y] where "X" is the slot number and "Y" is the word number.

Module Specifications

Current Draw: 450mA @5Vdc
55mA @ 24Vdc typical
200mA @ 24Vdc with reference voltage shorted

Throughput Time: 200µs to 300µs

Front Panel:



LED Function

Status LED

Solid Red: Module Fault, such as no reference voltage
Blinking Red: Non Clearable Transducer Fault
Blinking Green: Clearable Transducer Fault
Solid Green: Module and Transducer are OK

OK LED

Solid Green: Module Owned, two way communication
Blinking Green: PLC is in Program Mode or one way communication, module only sends data to the PLC
Blinking Red: Communication between module and PLC interrupted

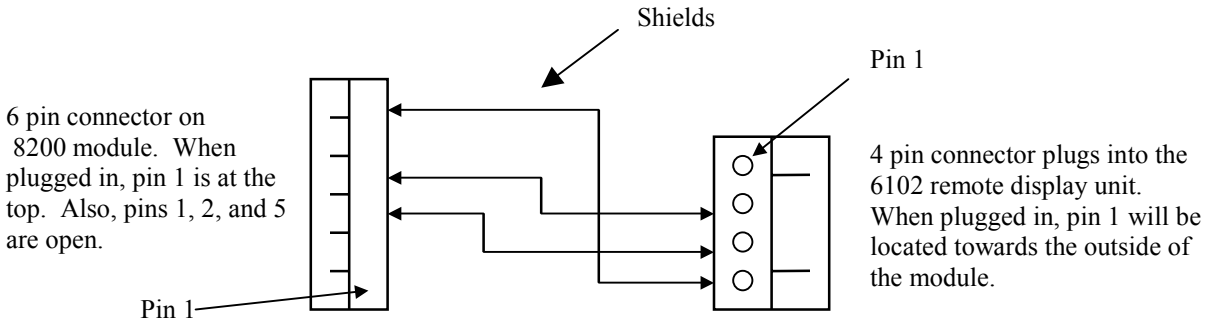
Connector Pin Out:

MS-8P Connector

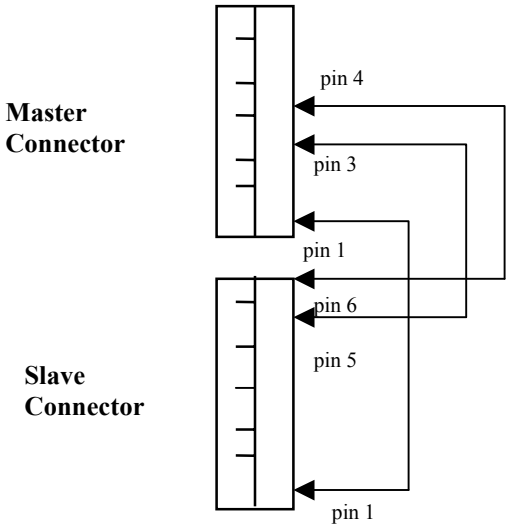
S3 (+sin, black of the white/black pair)
S1 (-sin, white of the white/black pair)
S4 (+cos, green of the green/black pair)
S2 (-cos, black of the green/black pair)
shields
shields
R2 (-ref, red of the red/black pair)
R1 (+ref, black of the red/black pair)

Note: The shield pins can be connected to the mounting tab of the rack chassis to provide a better low impedance path to ground.

Remote Display Connector and cable



Slave Mode Connector and Cable



Note: When plugged into the module, pin 1 will be located at the top of the connector

Input Table (Data sent from the 8200 module to the PLC)

This data is read by the PLC at the RPI (Rate Packet Interval) Time, which is asynchronous to the Ladder Logic Program. This data should be buffered to internal registers to insure that it is the same throughout the entire PLC program. **Note**, the minimum RPI time for the 8200 module is 0.3ms.

Word 0: Status Word

- bit 0: Setup Fault. Either the module has not been configured, or the Setup Data is not valid.
- bit 1: Programming Fault in the MESSAGE data containing the Group programming
- bit 2: Programming Fault in the MESSAGE data containing the Output or Analog Output programming. If any of the Programming fault bits are set, check the status MESSAGE data.
- bit 3: Output Increment/Decrement Output Number Error (set if the output number being incremented/decremented is invalid.
- bit 4: Output Increment/Decrement Output Setpoint Error. Set if the setpoint number being changed is outside of the range of 1 to 4, or 9. Also set if you try to increment or decrement past the other setpoint or you try to increment/decrement an output that has not been programmed.
- bit 5: Message Ignored Error: This bit will be set if an attempt is made to program a parameter while a programming error exists
- bit 6: Module Error: This bit will be set if the module self test fails, or if jumper JP4 is missing from the main board.
- bit 7: Transducer Fault - set if no transducer is attached, if the transducer is faulty, if the cable is improperly wired, or if the transducer is not compatible.
- bit 8: Motion Detect 1 bit: set when the velocity data is within the range of motion detect 1.
- bit 9: Motion Detect 2 bit: set when the velocity data is within the range of motion detect 2.
- bit 10: Set if the velocity data in I:X.2 exceeds 32,767. If this occurs, the velocity data will keep increasing, but will be negative in the input table because the MSB of velocity data word indicates the sign of the value.
- bit 11-15: reserved, set to zero

Word 1: Acknowledge word

bit 0: Increment/Decrement **ACK**nowledge bit
bit 1: Setup **ACK**nowledge bit
bit 2: Physical Output programming **ACK**nowledge bit
bit 3: Virtual Output programming **ACK**nowledge bit
bit 4: Analog l Output programming **ACK**nowledge bit
bit 5: Group programming **ACK**nowledge bit
bit 6: Reference Amplitude Programming **ACK**nowledge bit
bit 7: Reserved
bit 8: Status Reading Message **ACK**nowledge bit
bit 9: Physical programming Reading Message **ACK**nowledge bit (Currently does not work with ControlLogix)
bit 10: Virtual programming Reading Message **ACK**nowledge bit (Currently does not work with ControlLogix)
bit 13: Internal data Reading Message **ACK**nowledge bit

Word 2: Resolver (machine) position data
Word 3: Resolver Velocity data (RPM)
Word 4: Limit Switch Output status, limits 1 to 16. Sets a bit to indicate that the physical output is active. Bit 0 = output 1, Bit 1 = output 2 ... Bit 15 = output 16.
Word 5: Limit Switch Output status, limits 17 to 32. Sets a bit to indicate that the virtual output is active. Bit 0 = output 17, Bit 1 = output 18 ... Bit 15 = output 32.
Word 6: Physical Input Status, Sets a bit to indicate when a physical input is active. Bit 0 = input 1, Bit 1 = input 2 ... Bit 15 = input 16.

Words 7 though 12 will only be used if the module is configured to operate in Group Mode. These words will not be used on a module configured for independent mode.

Word 7: Group 1 Position
Word 8: Group 2 Position
Word 9: Group 3 Position
Word 10: Group 4 Position
Word 11: Group 5 Position
Word 12: Group 6 Position

Output Table (Data sent from the PLC to the 8200 module)

The output table controls the functions that may be performed every scan. The Force and Virtual Input functions do not require a transmit bit. However, the Increment/Decrement Function does.

Word 0: Output Setpoints Increment/Decrement Function
- Bits 0 → 5, the output number being changed, 1 → 32
- Bits 6 → 9: The On/Off Setpoint being changed, 1 → 4, or 9 to change all of the setpoints
- Bit 10: Change On setpoint
- Bit 11: Change Off setpoint

  To change both the On and Off setpoints with one operation, set both bits 10 and 11. If you don't want to increment or decrement a setpoint on both of the transitions of the transmit bit, reset both bits 10 and 11.

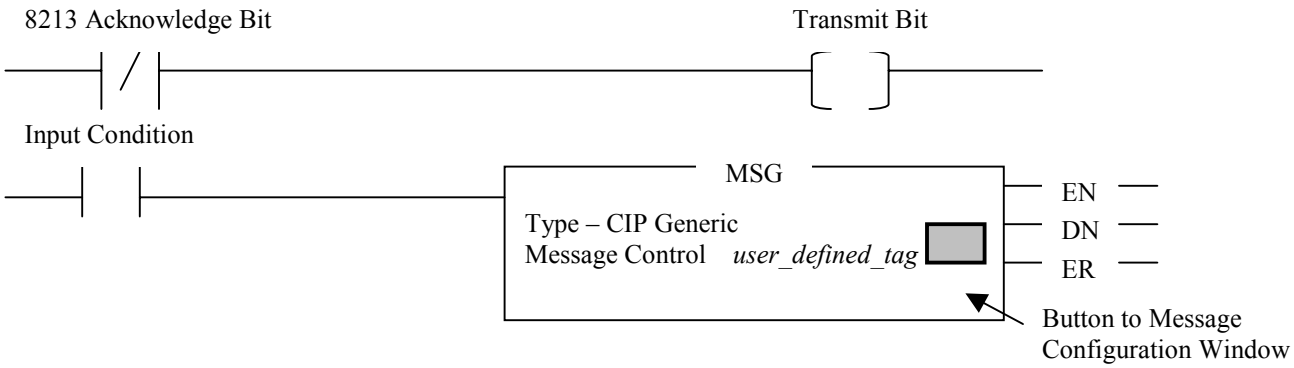
- Bit 12: Direction Bit, 0 = increment setpoint, 1 = decrement setpoint
- Bit 13: Reserved, must be set to zero
- Bit 14: Reset errors (All reset error bits perform the same function. If this clear error bit is set, the transmit bit must also be set. This function can be used without incrementing or decrementing the outputs, but setting bits 0 to 13 to 0)
- Bit 15: Increment/Decrement Transmit Bit. The programming operation will take place on either the 0 to 1 or 1 to 0 transition of the transmit bit.

Word 1: Force the Outputs On. Bit 0 = output 1, bit 1 = output 2 ... bit 15 = output 16
Word 2: Force the Outputs On. Bit 0 = output 17, bit 1 = output 18 ... bit 15 = output 32
Word 3: Force the Outputs Off. Bit 0 = output 1, bit 1 = output 2 ... bit 15 = output 16
Word 4: Force the Outputs Off. Bit 0 = output 17, bit 1 = output 18 ... bit 15 = output 32
Word 5: Virtual Inputs. bit 0 = Virtual Input 1, bit 1 = Virtual Input 2 ... bit 7= Virtual Input 8.
Word 6: Force Physical Inputs Off, bit 0 = input 1, bit 1 = input 2 ... bit 15 = input 16
Word 7: Force Physical Inputs On, bit 0 = input 1, bit 1 = input 2 ... bit 15 = input 16

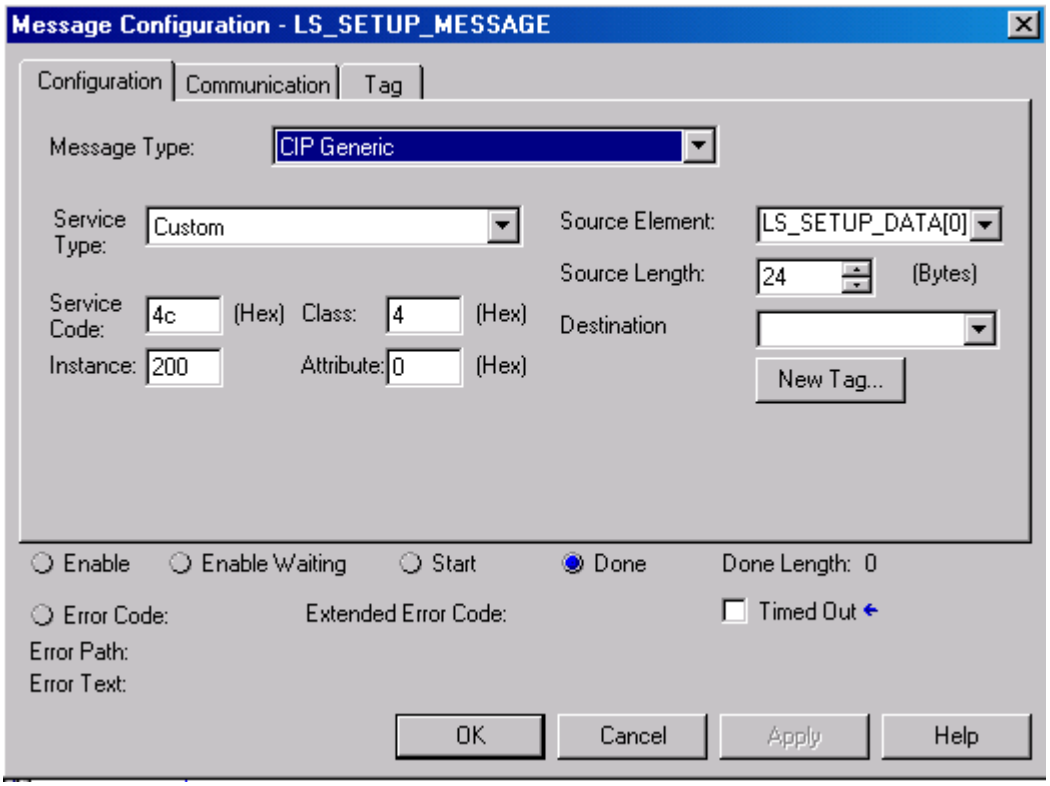
Note 1: It is not possible to increment or decrement an output when the on/off setpoints are the same.
Note 2: Outputs can be forced ON even if they have not yet been programmed.
Note 3: It is not possible to force the outputs on when there is a transducer fault.

Message Instructions

The programming of the Setup, Group, Output, Analog, and Reference Data, as well as the reading of Status Data, requires the use of Message Instructions. The format of this instruction is shown below.



1. The message instruction sends data to or reads data from the 8200 module only when the rung transitions from false to true.
2. The *user_defined_tag* used for Message Instruction Control must have the MESSAGE data type.
3. The data sent by the message instruction to the 8200 module will be acted upon on both the 0 to 1 and 1 to 0 transition of the transmit bit. The first rung shown above can be used to automatically toggle this bit.
4. Clicking on the button in the Message Instruction opens the Message Configuration Window, shown below.



Service Type: Must be Custom
Service Code: See the table on page 8
Class: See the table on page 8
Instance: See the table on page 8
Attribute: Must be set to zero.

Source Element: If the Message Instruction is being used to send data to the 8213 module, then the source parameter will be the tag that contains the data to be sent to the 8213 module.

If the Message Instruction is being used to read data from the 8213 module, than the source parameter must be left blank.

Source Length: If the Message Instruction is being used to send data to the 8213 module, then the Source Length parameter must be set to the number of bytes of data that are being sent to the module. See the tables below for a listing of the number of elements.

If the Message Instruction is being used to read data from the 8213 module, then the Source Length Parameter must be set to zero.

Destination: If the Message Instruction is being used to send data to the 8213 module, then the Destination Parameter must be left blank.

If the Message Instruction is being used to read data from the 8213 module, then the Destination Parameter must be set to the tag address where the data will be placed.

Message Configuration – *user defined tag* (Communication Tab)

When the Configuration window shown above is completed, click on the Communication tab and set the path parameter to the 8213 module. All of the remaining Communication parameters can remain at their default settings. The Message Instruction is used with the following information to program the 8213 module.

LADDER MESSAGES FOR PROGRAMMING PARAMETERS

Setup	Service Code	4C	Class	4	In all 8200 Modules
	Instance	200	Number of Bytes	24	
Physical Outputs, single time dwell	Service Code	4C	Class	4	
	Instance	201	Number of Bytes	388	
Virtual Outputs	Service Code	4C	Class	4	
	Instance	202	Number of Bytes	388	
Analog Outputs	Service Code	4C	Class	4	
	Instance	203	Number of Bytes	12	
Physical Outputs in Time Mode	Service Code	4C	Class	4	NOT to be used together with virtual outputs
	Instance	204	Number of Bytes	388	
Grouping Channels	Service Code	4C	Class	4	Grouping Configuration
	Instance	210	Number of Bytes	52	
Reference Voltage Programming	Service Code	4C	Class	4	Technological Adjustment
	Instance	220	Number of Bytes	4	

Note 1: Programming Physical Outputs in time mode will generate a command error if Virtual Outputs have already been programmed. The same is true if Virtual Outputs are programmed after the Physical Outputs in time mode.

Note 2: The module's power must be cycled when switching from group functionality to simple limit switch functionality.

Note 3: The message instructions that send the programming data to the 8200 module have an error word associated with their status bits. This word has an address of *user_tag.exerr*, where *user_tag* has the Message data type. The error codes that the 8200 module places in this status word are shown in the Status Reading Message section of these specifications.

The Message Instruction is used with the following information to read status information from the 8200 module.

LADDER MESSAGES FOR DIAGNOSTIC INFORMATION

Status Data	Service Code	4B	Class	4	In all 8200 Modules
	Instance	200	Number of Bytes	10	
Physical Programming	Service Code	4B	Class	4	Does not work with ControlLogix
	Instance	201	Number of Bytes	388	
Virtual Programming	Service Code	4B	Class	4	
	Instance	202	Number of Bytes	388	
Internal Data	Service Code	4B	Class	4	Technological Adjustment
	Instance	220	Number of Bytes	18	

Setup Programming Message (24 Bytes)

Setup Data. All of the data MUST be present each time the Configure Transmit bit is toggled.

To make the programming of setup data easier, a new user defined tag, SETUP, should be created. This tag will have the following format.

Word 0: Programming Control Bits

bit 0: Reset Errors (all reset errors bits perform the same function)

bit 1: Apply Preset Value (Sets position data sent to the input table to the preset value. It is possible to preset the position even if the unit is in transducer fault.)

bits 2 → 3: not used, must be set to zero

bit 4: Program Direction, 0 = CW increasing, 1 = CCW increasing

bit 5: Program Display Tach Response, 0 = 504ms, and 1 = 120ms. Internally, the tachometer response is set to 24ms, which is used to calculate the output advance times.

bits 6 & 7: reserved for future use

bit 8: COS Use: 0 = don't use Change Of State functions, 1 = use COS functions

The COS feature causes the PLC to read the new virtual output status each time the state of one of the virtual outputs changes.

bit: 9: Slave Mode, 0 = 8200 used as master, 1 = 8200 used as slave

bit: 10: 0 = Serial Port used to transmit position and velocity data to a Remote Display unit
1 = Serial port used to either send data as a Master Unit, or receive data as a Slave Unit. If the unit is used as a slave, bit 9 must also be set.

bits 11 → 14: reserved, must be set to zero

bit 15: Setup Transmit bit. The Setup data sent by the message instruction to the 8200 module will be acted upon on both the 0 to 1 and 1 to 0 transition of the transmit bit.

Word 1: Scale Factor, range of 2 → 4096, default of 1024
Word 2: Preset Value, range of 0 → (SF - 1)
Word 3: Offset Value, range of 0 → (SF - 1) This value is added to the resolver's absolute position and must be present each time the configuration data block is written to the module. The offset value that was generated by a Preset Operation is located in the *Position Offset* word in *Status Message*.
Word 4: Motion detect 1 lower level (rpm), 0 to 32,767
Word 5: Motion detect 1 upper level (rpm), 0 to 32,767
Word 6: Motion detect 2 lower level (rpm), 0 to 32,767
Word 7: Motion detect 2 upper level (rpm), 0 to 32,767

Note: If the motion detect lower value is greater than the upper value, then the motion detect input bit will be on outside of the programmed range.

Word 8: Physical Input Active State, bit 0 = input 1, bit 1 = input 2 ... bit 15 = input 16. With the bits set to 1, a normally open switch must be closed to activate the input. With the bits set to 0, a normally closed switch must open to active the input.
Word 9: velocity multiplier value, range 0 to 1100.
Word 10: velocity divider value, range 1 to 63. If word 9 is 0, the divider value can be 0.
Word 11: velocity decimal point value, range 0 to 3. 0 = divide velocity by 1, 1 = divide velocity by 10, 2 = divide velocity by 100, 3 = divide velocity by 1000.

Note: Velocity multiplier only affects the velocity data. The motion detectors and advances still act on the RPM data.

The following table shows the configuration of the SETUP data type, when created in RSLogix 5000.

Name	**Data Type**	**Style**
Control_Bits	INT	Hex
Scale_Factor	INT	Decimal
Preset	INT	Decimal
Offset	INT	Decimal
lower_MD1	INT	Decimal
upper_MD1	INT	Decimal
lower_MD2	INT	Decimal
upper_MD2	INT	Decimal
IN_Active_State	INT	Hex
Velocity_Multiplier	INT	Decimal
Velocity_Divider	INT	Decimal
Velocity_Decimal	INT	Decimal

Group Programming Message (52 bytes)

Group Data. All of the data MUST be present each time the Group Transmit bit is toggled.

To make the programming of groups easier, three types of user defined data types, SETPOINT, GROUPING, and SIX_GROUPS, should be created. These tags will have the following format.

Setpoint (4 bytes) (The Setpoint data type can also be used for Output programming)

Word 0: ON Position
Word 1: OFFPosition

The following table shows the configuration of the SETPOINT data type, when created in RSLogix 5000.

Name	Data Type	Style
On	INT	Decimal
Off	INT	Decimal

Grouping (8 bytes)

Word 0: Group Configuring Control Bits
bits 0 → 5: the number of limit switch outputs in the group, range of 1 → 16
bits 6 → 7: not used, must be reset to zero
bits 8 → 10: the mode used in the group, 0 → 5
bits 11 → 12: not used
bit 13: selects first cycle input, "0" = physical input, "1" = virtual input
bit 14: selects which type of outputs are being controlled by the group, "0" = physical output, "1" = virtual output
bit 15: set to 1 when the group is to be used, reset if the group is disabled

Word 1: Offset/Preset Value. Offset value for modes 0, 3,4, and 5 and Preset Value for modes 1 and 2. Range = 0 to (SF -1). The offset value is added to the machines offset position.

Words 2,3: Setpoint (Channel ON/OFF Positions, made up of the Setpoint data type created above)

Note 1: Bit 14 of the group setup programming word selects which of two dedicated inputs, either virtual or physical, will be used to control the group. If the group has physical outputs, then a physical input must be used. Likewise, if the group has virtual outputs, then a virtual input must be used. The following table shows which inputs will be used for the group control. The only exception to this is the first cycle input, where a virtual input can control a physical group or vice versa.

	Physical Input	Virtual Input
Group 1	1	17
Group 2	2	18
Group 3	3	19
Group 4	4	20
Group 5	5	21
Group 6	6	22
Enable	7	23
First Cycle	8	24

Note 2: All groups programmed for physical outputs will have their outputs numbered consecutively. Output 1 will always be assigned to first group programmed for physical outputs. The first output of a second group programmed for physical outputs will always be the output following the last one programmed in the previous physical group. The programming sequence of the virtual output groups is the same as the physical output group's programming.

Note 3: Each of the Group On/Off setpoints shown above has a range of 0 to (Scale Factor - 1). The On/Off Setpoints program the Group channel range.

The following table shows the configuration of the GROUPING data type, when created in RSLogix 5000. The setpoint data type was created above.

Name	Data Type	Style
Control_Bits	INT	Hex
Offset/Preset	INT	Decimal
+ Setpoint	SETPOINT	

.

Six_Groups (52 bytes)

Words 0 and 1: Programming Control bits in DINT (Double Precision Integer) Format

bit 0: set to reset errors (all reset error bits perform the same function)
bits 1 → 14: reserved, must be set to zero
bit 15: Group Programming Transmit Bit - The Group programming data sent by the message instruction to the 8200 module will be acted upon on both the 0 to 1 and 1 to 0 transition of this transmit bit.
bits 16 to 31: reserved, must be set to zero.

Word 2 → Word 25: Programming data for group channels, where each is made up of the grouping data type created above.

Words 2 to 5: Grouping 1
Words 6 to 9: Grouping 2
Words 10 to 13: Grouping 3
Words 14 to 17: Grouping 4
Words 18 to 21: Grouping 5
Words 22 to 25: Grouping 6

The following table shows the configuration of the Six_Group data type, when created in RSLogix 5000. The Grouping data type was created above.

Name	Data Type	Style
Control_Bits	DINT	Hex
group_1	GROUPING	
group_2	GROUPING	
group_3	GROUPING	
group_4	GROUPING	
group_5	GROUPING	
group_6	GROUPING	

Output Setpoint Programming (the setup data must be programmed first)
(388 bytes for the Physical Outputs and 388 bytes for the Virtual Outputs)

Output Setpoint Data. All of the data MUST be present each time the Output Transmit bit is toggled. Any unused data should be set to zero.

To make the programming of Output Setpoints easier, three user defined data types, SETPOINT, OUTPUT, and SIXTEEN_OUTPUTS, should be created. These tags will have the following format.

Setpoint (4 bytes) (The Setpoint data type can also be used for Group programming)

Word 0: ON Position
Word 1: OFF Position

The following table shows the configuration of the SETPOINT data type, when created in RSLogix 5000.

Name	Data Type	Style
On	INT	Decimal
Off	INT	Decimal

Output (24 Bytes)

Words 0 and 1: Programming Control bits in DINT (Double Precision Integer)

bits 0 → 1: output type

Bit 1	Bit 0	Function
0	0	output not used
0	1	pulse output
1	0	timed output
1	1	normal output

bits 2 → 12: not used
bits 13 → 14: motion ANDing control bits

Bit 14	Bit 13	Function
0	0	no motion ANDing
0	1	motion ANDing 1
1	0	motion ANDing 2
1	1	reserved

bit 15: set for Output Enable ANDing (by input), reset for no ANDing
bits 16 to 31: reserved, must be set to zero

Word 2: Output On advance/retard (entered in 0.1 ms) maximum = ±499.9ms
Word 3: Output Off advance/retard (entered in 0.1 ms) maximum = ±499.9ms
Words 4 and 5: Setpoint 1
Words 6 and 7: Setpoint 2
Words 8 and 9: Setpoint 3
Words 10 and 11: Setpoint 4

The following table shows the function of each of the setpoint words for the different output types.

	Normal Output Type	Pulsed Output Type	Timed Output Single Dwell	Pulsed Output Time Mode	Timed Output Time Mode
Setpoint 1 On	Setpoint 1 On	On position, leading edge of 1st pulse	Setpoint 1 On	On position, leading edge of 1st pulse	Setpoint 1 On
Setpoint 1 Off	Setpoint 1 Off	Off Position, trailing edge of last pulse	Setpoint 1 Off	Off Position, trailing edge of last pulse	Setpoint 1 Off
Setpoint 2 On	Setpoint 2 On	Total Number of Pulses	Dwell Time	Total Number of Pulses	Setpoint 2 On
Setpoint 2 Off	Setpoint 2 Off	Duration of each pulse in counts	0	Duration of each pulse in counts	Setpoint 2 Off
Setpoint 3 On	Setpoint 3 On	0	0	Dwell Time for each pulse in message 204	Setpoint 1 Dwell Time
Setpoint 3 Off	Setpoint 3 Off	0	0	0	Setpoint 2 Dwell Time
Setpoint 4 On	Setpoint 4 On	0	0	0	0
Setpoint 4 Off	Setpoint 4 Off	0	0	0	0

Note 1: The advances are programmed in 0.1ms increments. For example, if the value to be entered is 5.3ms, then the value entered in the data table would be 53. If the desired function is to retard the output instead of advance it, the value entered in the data table should be negative. For example, to retard the output by 6.7ms, enter a value of -67 in the data table.

Note 2: The On/Off setpoints have a range of 0 to (Scale Factor - 1).

Note 3: Any output can be programmed as timed. The output will activate only when both the On setpoint is reached and the output's associated input is active. (The timing operation does not start until the input is active.) The output turns off when the timer has reached the value entered in the time value. However, in messages 201 and 202 if the Off setpoint is reached before the timer times out, the timing will be aborted, and the output will turn off immediately.

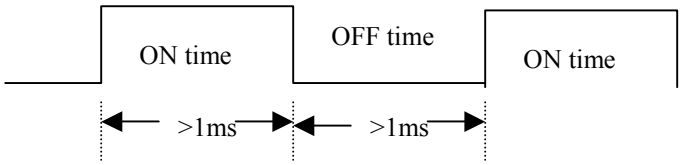
Note 4: In messages 201 and 202, if the output type is selected as Timed, only the On/Off setpoint 1 will be used. Any values entered in the words containing Off setpoint 2 through Off Setpoint 4 will be ignored. Up to four physical and four virtual timed outputs can be programmed. Exceeding this number will cause an error bit to be set.

Note 5: If the output type is selected as pulsed, the words containing On/Off setpoints 3 to 4 will be ignored. In messages 201 and 202. In message 204 the <Setpoint 3 On> word defines the Dwell Time for each pulse. The words for <Setpoint 3 Off> and <Setpoint 4 On/Off> are ignored.

Note 6: In Time Mode, all 16 physical outputs can be programmed as Timed. Messages for programming virtual outputs cannot be used when message 204 is active, or Message 204 cannot be used if virtual outputs have already been programmed.\

Note 7: In time mode, if only one timed output is required, than the second on/off setpoint pair must be zero or a 1ms wide pulse will occur at the on point of the second on/off setpoint pair.

Note 8: In Time Mode, the outputs turn off based only on the programmed time value. However, in order to internally function correctly, the 8200 modules requires the programming of both the count based On and Off setpoints. To fire the output correctly, the module also requires that both the ON time and OFF time must exceed 1ms, and that the output must be off for 1ms between when the timer expires and when the next On setpoint is reached. If either the ON or OFF times are less than 1ms, than the module will output 1 pulse instead of 2.



Example

Scale Factor = 4096 Counts
Maximum Machine Speed = 100rev/min
First Programmed On Setpoint position = 1500

100rev/min * 1min/60,000ms * 4096 counts/rev = 6.83counts/ms

Therefore in order for the outputs to fire correctly, the lowest possible value that the first Off Setpoint is 1507, and the next On setpoint cannot be programmed lower than 1514.

Continuing this example, if Pulsed outputs are being programmed in Time Mode, than the Duration Parameter (the setpoint 2 off value) must be a value greater than 7.

The following table shows the configuration of the Output data type, when created in RSLogix 5000. The setpoint data type was created above.

Name	Data Type	Style
Control_Bits	DINT	Hex
On_Advance	INT	Decimal
Off_Advance	INT	Decimal
+ Setpoint_1	SETPOINT	
+ Setpoint_2	SETPOINT	
+ Setpoint_3	SETPOINT	
+ Setpoint_4	SETPOINT	

Sixteen_Outputs (388 Bytes)

Words 0 and 1: Programming Control bits in DINT (Double Precision Integer) Format

bit 0: set to reset errors (all reset error bits perform the same function)
bits 1 → 14: reserved, must be set to zero
bit 15: Output Programming Transmit Bit - The Output programming data sent by the message instruction to the 8200 module will be acted upon on both the 0 to 1 and 1 to 0 transition of this transmit bit.
bits 16 to 31: reserved, must be set to zero.

Word 2 → Word 193: Programming data for 16 outputs channels, where each output is made up of the output data type created above.

Words 2 to 13: Output 1
Words 14 to 25: Output 2
Words 26 to 37: Output 3
Words 38 to 49: Output 4
Words 50 to 61: Output 5
Words 62 to 73: Output 6
Words 74 to 85: Output 7
Words 86 to 97: Output 8
Words 98 to 109: Output 9
Words 110 to 121: Output 10
Words 122 to 133: Output 11
Words 134 to 145: Output 12
Words 146 to 157: Output 13
Words 158 to 169: Output 14
Words 170 to 181: Output 15
Words 182 to 193: Output 16

The following table shows the configuration of the Sixteen_Outputs data type, when created in RSLogix 5000. The Output data type was created above.

Name	**Data Type**	**Style**
Control_Bits	DINT	Hex
+ Output_1	OUTPUT	
+ Output_2	OUTPUT	
+ Output_3	OUTPUT	
+ Output_4	OUTPUT	
+ Output_5	OUTPUT	
+ Output_6	OUTPUT	
+ Output_7	OUTPUT	
+ Output_8	OUTPUT	
+ Output_9	OUTPUT	
+ Output_10	OUTPUT	
+ Output_11	OUTPUT	
+ Output_12	OUTPUT	
+ Output_13	OUTPUT	
+ Output_14	OUTPUT	
+ Output_15	OUTPUT	
+ Output_16	OUTPUT	

Analog Output Programming (12 Bytes)

To make the programming of the Analog Outputs easier, a new data type should be created. This data type will have the following format.

Analog (12 bytes)

Words 0 and 1: Analog Output Programming Control Bits
- bit 0: set to reset errors (all reset errors bit perform the same function)
- bit 1: set to enable analog output 1
- bit 2: analog output 1 type: 0 = voltage, 1 = current
- bits 2 → 8: reserved, must be set to zero
- bit 9: set to enable analog output 2
- bit 10: analog output 2 type: 0 = voltage, 1 = current
- bits 11 → 14: not used, must be set to zero
- bit 15: Analog Output Programming Transmit Bit - The Analog Output programming data sent by the message instruction to the 8200 module will be acted upon on both the 0 to 1 and 1 to 0 transition of this transmit bit.
- bits 16 → 31: reserved, must be set to zero

Word 2: RPM value at which analog output 1 is outputting its maximum value, range = 0 to 32767
Word 3: Analog output 1 value at 0 RPM
Word 4: RPM value at which analog output 2 is outputting its maximum value, range = 0 to 32767
Word 5: Analog output 2 value at 0 RPM

Note 1: The Analog outputs are based on the resolver speed, not on its position.
Note 2: Voltage values are entered in 10mV increments, XX.XX volts, and have a range of 0.00Vdc to 10.00Vdc.
Note 3: Current values are entered in 10μA increments, XX.XXmA, and have a range of 4.00mA to 20.00mA.
Note 4: Only positive voltage or current values can be output.
Note 5: The programmable voltage values that can be entered are -999 to 999. If a value outside of this range is entered, status bit 7 in the *OUTPUT PROGRAMMING STATUS WORD* will be set. A negative voltage value can be programmed only to provide a different output profile. The minimum value at 0 RPM will always be 0Vdc.
Note 6: The programmable current values that can be entered are -1199 to 1999. If a value outside of this range is entered, status bit 7 in the *OUTPUT PROGRAMMING STATUS WORD* will be set. A negative current value can be programmed only to provide a different output profile. The minimum value at 0 RPM will always be 4.00mA.
Note 7: If the resolver's velocity exceeds what has been programmed, the output will remain at its maximum value.
Note 8: Whenever the analog outputs are used, physical outputs 13 to 16 are taken and cannot be used for other purposes.
Note 9: Analog Output 1 must be programmed before Analog output 2. If output 2 is programmed before 1, error bit 6 in the *OUTPUT PROGRAMMING STATUS WORD* will be set.
Note 10: The following procedure can be used to calculate output values:
a) The formula is Output = m * (RPM) + b
b) Determine the output value at zero speed (RPM)
c) Determine a 2nd output value at a 2nd speed
d) b = output value at zero speed
e) m = (2nd output - b)/ (2nd RPM)
f) If the 2nd output value is not the maximum, calculate the maximum RPM.
RPM max = (max output - b)/m
g) Multiply the output at zero speed by 100 and place the value in the correct registers for output 1 or for output 2.

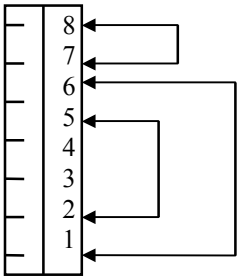
The following table shows the configuration of the Analog data type, when created in RSLogix 5000. The setpoint data type was created above.

Name	Data Type	Style
Control_Bits	DINT	Hex
Out_1_Max_RPM	INT	Decimal
Out_1_Min	INT	Decimal
Out_2_Max_RPM	INT	Decimal
Out_2_Min	INT	Decimal

Reference Amplitude Programming Message (4 bytes)
Internal use only

This feature will work only when a jumper strap is installed on header JP3 of the 8200 board and a test MS-8P connector is installed in the resolver connector of the module. The test MS-8P connector has the following wiring.

Test MS-8P Connector



Two words are required to send this data to the 8200 module. A new data type can be created, but it is not necessary. These two words have the following format.

Word 0: Programming Control Bits
bit 0: reset errors (all reset errors bits perform the same function)
bits 1 → 14: reserved, must be set to zero
bit 15: Reference Voltage Transmit bit, toggled to transfer the reference voltage data to the module

Word 1: Reference voltage setting word. Used to set the reference voltage during the initial test of the 8200 module. This word is only read when a jumper is installed on header JP3 of the 8200 board. This register has a valid range of 4096 to 8320, but a value of about 7400 will set the correct value.

Diagnostic Information Reading Message

The following information can be read from the module using a Service Code of 4B and an Instance Name of 220.

Word 0: Sine value
Word 1: Cosine value
Word 2: Position in 8192 units
Word 3: Phase shift
Word 4: Active value on Digital Potentiometer for REF amplitude
Word 5: Low Preset value for Digital Potentiometer
Word 6: High Preset value for Digital Potentiometer
Word 7: Analog output 1 in 1/2048 units
Word 8: Analog output 2 in 2048 units

Status Reading Message

The Message Instruction is used to read Status Information from the 8200 module. The data that is read is placed in user defined tag addresses. The format of this data is shown below.

Word 0: Position Offset, generated by a Preset operation. This word must be copied to the *Offset Value* word in the *Setup Data* each time the configuration data is programmed in order to keep the position absolute.
Word 1: Module Configuration Status Word
- bit 0: Scale Factor Error
- bit 1: Preset Value Error
- bit 2: Offset Value Error
- bit 3: Motion Detect 1 error, set if the values are negative or equal but not zero
- bit 4: Motion Detect 2 error, set if the values are negative or equal but not zero
- bit 5: Rate Programming error, set if the multiplier, divider or decimal point values are out of range.
- bits 6 to 13: reserved for future use
- bit 14: Message ignored bit. Set if a new setup command has been issued, without the Clear Error bit set, when a previous command on a different Message Block has been signaled as being invalid
- bit 15: set when there is a Command Word Format Error, such as setting bits in Setup Word 0 that should be zero, or setting the transmit bit without setting any other bits

Word 2: Output Programming Status Word
- bit 0: Set if an Output's On setpoint is invalid
- bit 1: Set if an Output's Off setpoint is invalid, if all the on/off setpoints are 0 with the output is enabled, or if the on setpoint = off setpoint and they are not zero.
- bit 2: Set if an Output's Advance Value is invalid, including advances applied to timed and pulse outputs
- bit 3: Set if an Output's Timed Output Value is outside of 0 to 9999. Also set if the on/off setpoints of the timed output are outside of the (Scale Factor – 1) range
- bit 4: Set if the number of Timed Outputs exceeds the maximum allowable value, 4 physical and 4 virtual if programmed for single dwell using instance 201. Sixteen timed outputs can be programmed if instance 204 is used to program the module in Time Mode.
- bit 5: Set if an Output's Pulsed Output Programming is invalid, as shown by the following formula

  (Trailing Edge – Leading Edge) < ((Pulse Quantity * On Count) + (Pulse Quantity – 1))

  Also set if the on/off setpoints of the pulse output are outside of the (Scale Factor – 1) range

- bit 6: Set if there is an analog output programming error, such as using output 2 without 1
- bit 7: Set if an analog output parameter is incorrect
- bit 8: Set if the outputs are disabled. This can be caused by either a transducer fault, or if the module has not yet been programmed. If the outputs have been programmed, this bit can be reset by any of the clear error commands. The bit can also be cleared by programming the output data.
- bits 9 → 13: reserved for future use
- bit 14: Message ignored bit. Set if a new setup command has been issued, without the Clear Error bit set, when a previous command on a different Message Block has been signaled as being invalid. This bit will also be set if the outputs are programmed before the setup data.
- bit 15: Command Word Format Error, set under the following conditions.

  1. Setting bits in the command word, including the Analog Output Command Word, that should be zero.
  2. If the 8200 module is being used in group mode, this bit will be set if the outputs are programmed before the groups.
  3. If outputs that have not been defined by the group programming. For example, if only 4 outputs are assigned to the groups, then programming output 5 will set this bit.
  4. If both motion ANDing bits 13 and 14 are set.
  5. Programming the virtual outputs after using a Message Instruction with Instance 204 to program the outputs. Instance 204 allows the programming of outputs in time mode.
  6. If Instance 204 is used after Virtual Outputs have already been programmed.
  7. Transmitting the output data without any control bits set.

Word 3: Output Programming Diagnostics - If any of the error bits 0 to 7 of the *Output Programming Status Word* are set, this word will indicate which output has the error, 1 to 32. If there is a problem with the Analog Output Programming, this value will be 1 or 2.

Word 4 Output Programming Diagnostics - If either bits 0 1 of the *Output Programming Status Word* are set, this word will indicate which On/Off pair has the error, 1 to 4. If the error is caused by the On setpoint equaling the Off Setpoint, this register will show a value of 4.

Word 5: Group Output Programming Status Word

- bit 0: Group Offset/Preset Value error
- bit 1: Group Programming Error, set if the number of outputs or the mode is invalid.
- bit 2: Group channel On/Off setpoint is outside of its range
- bits 3 → 13: reserved for future use
- bit 14: Message ignored bit. Set if a new setup command has been issued, without the Clear Error bit set, when a previous command on a different Message Block has been signaled as being invalid. Also set if the groups are programmed when the module in Independent Mode.
- bit 15: set when there is a Command Word Format Error, such as setting bits in the command word which should be zero, or setting the transmit bit without setting any other bits

Word 6: Group Number Error - If bits 0, 1 or 2 of the *Group Output Programming Status Word* are set, this word will indicate which group has the error by showing a value of 1 to 6

Revision History:

Revision 1.0 was released on 5/18/01 and was the initial release of the specifications.

Revision 1.1 was released on 8/14/01. The name was changed to from 2200 to 8200. Time Mode and Slave Mode were added to the module. The advance range was increased from ±99.9ms to ±499.9ms. The message instruction example was changed to that the rung with the transmit bit was located above the message instruction.

Revision 1.2 was released on 1/9/02. The current draw of the module was added, as was a note regarding the second on/off setpoint pair of timed outputs

Revision 1.3 was released on 6/5/02. The setup screen for the Message instruction was pasted into the specifications. The Attribute Name was changed from having to be left blank to having to be set to zero. Transmitting output data without any control bits set was added as a condition to the Command Word Format Error.

Extended Error Codes

The Message Instructions used to send data to the 8200 module have an error register that can be used to obtain diagnostic information from the module. This register's address is *user_tag*.exerr. The following table shows the values that will be displayed in this register for the various Message Instructions used to send data to the 8200 module. Please note that these error codes are only valid when register address *user_tag.err* is equal to 9, and that the causes of the errors are shown in the Status Reading Message section above.

Message Instruction Function	Instance Name	Extended Error Codes (located in user_tag.exerr)
Setup Data	200	0 = Message Ignored Error 1 = Command Word Format Error 2 = Scale Factor Error 3 = Preset Value Error 4 = Offset Value Error 5 = Motion Detect 1 Error 6 = Motion Detect 2 Error 7 = Rate Programming Error
Physical Outputs, single time dwell	201	0 = Message Ignored Error 1 = Command Word Format Error 2 = Reserved 3 = Advance Value Error 4 = Outputs On Setpoint is invalid 5 = Outputs Off Setpoint is invalid 6 = Timed Output programming is invalid 7 = The number of Timed Outputs exceeds the maximum allowable value 8 = Pulse Output programming is invalid
Virtual Outputs	202	0 = Message Ignored Error 1 = Command Word Format Error 2 = Reserved 3 = Advance Value Error 4 = Outputs On Setpoint is invalid 5 = Outputs Off Setpoint is invalid 6 = Timed Output programming is invalid 7 = The number of Timed Outputs exceeds the maximum allowable value 8 = Pulse Output programming is invalid
Analog Outputs	203	0 = Message Ignored Error 1 = Command Word Format Error 2 = Analog Output Programming error
Physical Outputs, in Time Mode	204	0 = Message Ignored Error 1 = Command Word Format Error 2 = Reserved 3 = Advance Value Error 4 = Outputs On Setpoint is invalid 5 = Outputs Off Setpoint is invalid 6 = Timed Output programming is invalid 7 = The number of Timed Outputs exceeds the maximum allowable value 8 = Pulse Output programming is invalid
Group Programming	210	0 = Message Ignored Error 1 = Command Word Format Error 2 = Group Programming Error 3 = Group Channel On/Off setpoint error 4 = Offset/Preset Value Error

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