3-Axis Accelerometer & 3-Axis Gyro

MSENS-GY

User's Manual

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Before using

1. This equipment is 3-axis, use the following information to be checked.
2. Check used to test the power. 10 ~ 30Vdc voltage is used. In noisy environments must be connected to the ground.
3. Connect the correct cable to determine the index, please. Incorrect connection may result in damage of the equipment.
4. 1 year warranty on this product.

Applications

1. Navigation of vehicle, Speed detecting.
2. Earthquake Detection, Tilt measurement
3. Motion Control
4. Virtual Reality System Application
5. Measurement of the bridge safety inspection
6. vibration of Facilities, equipment and structures detection

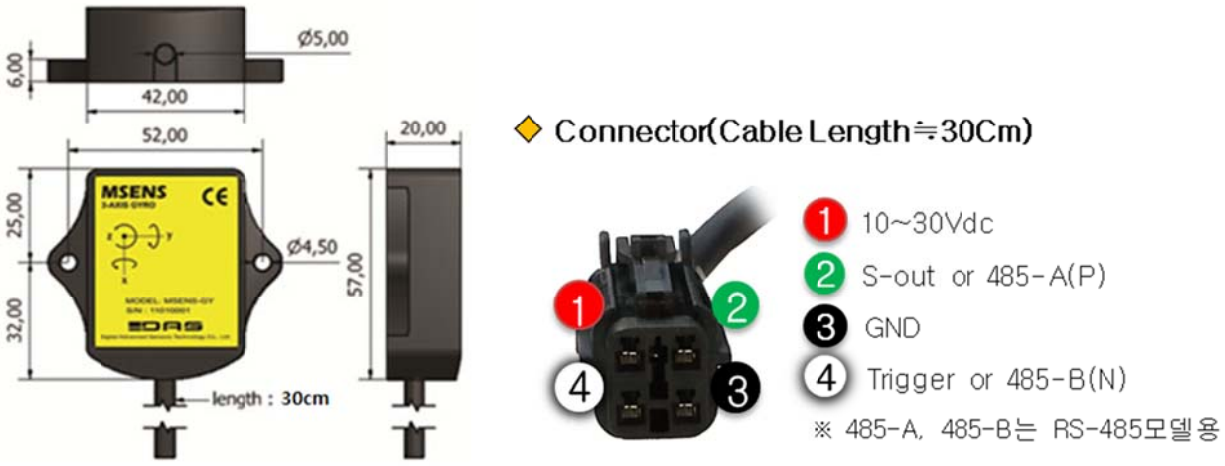
1 MSENS-GY features and specifications

1 - 1 Features

The main advantage of MSENS-GY is to measure motion about all directions, and it is possible to output angle value about gyro. It provides best solution about any application by Microprocessor. The user settings can be stored in internal memory of sensor. (direction, the analog output range, the sensor ID, specify the initial value, etc.) In addition, because the sensor RS-485 communication can be connected to more than 1Km, a line can be connected to Maximum 254 sensors. Core sensor shield to prevent penetration through the strong noise, motors, etc. can be used in strong noise environment. Sensors have been molded silicone inside can be used in inclement weather

1 - 2 Size

Size



Pic 1.1 MSENS-GY size

1 – 3 Specifications

- **Measuring Range**

  Angle(Roll,Pitch, Yaw) : ±180 full-range

  Angular velocity. (Roll,Pitch, Yaw) : ±250, ±500, ±2000 °/sec

- **Core sensor**
  - 3 axis gyro + 3 axis accelelometer.
  - Range(Roll ,Pitch, Yaw, °/sec) : ±250 (default)
  - Bias Stability In-Run(°/hr) : < 12
  - Bias Stability Over Temp(°/sec) : <±0.5
  - Scale Factor Accuracy(%) : <1
  - Resolution(°/sec) : 0.02
  - Angle Random Walk(°/sq-rt hr) : <3
  - Bandwidth(Hz) : 100

- **Power**

  Typical : 12Vdc

  The sensor was unregulated power (10~30Vdc) supply is also available.

  Current : <50mA at 12Vdc

- **Resolution**

  Gyro angular velocity : 8.75 mdps

  Gyro Angle output : 0.1°

  Max total error : 0.25%(FS)

- **Housing**

  IP66, PVC Case, Water-proof Housing : The Sensor can be waterproof silicone molding.

- **OperationgTemperature**

  -20 to .. +85°C

- **Weight**

  about 68g

- **Cable**

  6P Shield cable, 50CM

2 Output

2 - 1 2 - 1 RS-485 Serial output (default 115200,8,1,n)

format : Ex) [1␣0␣1234␣45␣1923]54**CR** **('␣' is space)**

[ID␣MODE␣X(ROLL)␣Y(PITCH)␣Z(YAW)]+Checksum+ **CR**

2 - 2 0~5V Voltage output. (default type)

- Yellow cable through the output.
- User can change output axis by serial command.
- Lowest range : 100mV (It can be changed between 100 ~ 1,000mV by order made)
- Highest range : 4900mV (It can be changed between 4000 ~ 4900mV by order made)
- Center Value : middle value between Low output and High output

2 - 3 4~20mA Current output .(order made)

- Yellow cable through the output.
- User can change output axis by serial command.
- Lowest range : 4.32mA
- Highest range : 19.68mA
- Center Value : 12mA.

3 Sensor axis directions

MSESE-GY measures 3-axis gyro sensor (Roll, Pitch, Yaw).

3-axis directions are following.

X (Roll)

Y (Pitch) Z (Yaw)

Pic .3-1 Each axis direction

Pic .3-2 3-axis directions

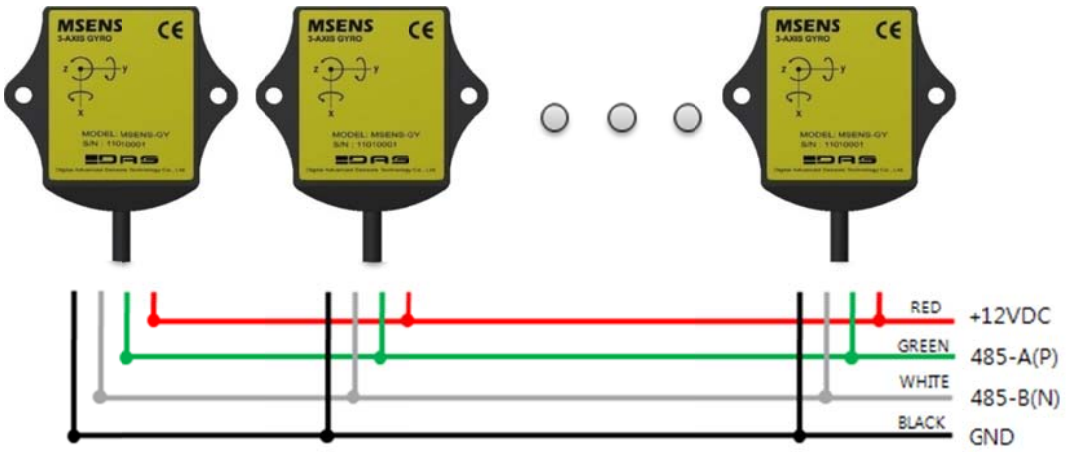
4 Wiring

MSESE-GY for a six-stranded shielded cable is used. Supply voltage 2-line, RS-485 2-line, mA output consists of a line. RS-485 and the unused line of mA output does not touch the other by cutting the cable must be insulated. When using RS-485 distance is longer than 50M 120 Ohm termination is recommended. In addition, if multiple sensors connected in parallel to use in the termination resistors.

4 - 1 RS-485 Wiring.

RS-485 communications can be read sensor value when the one or more sensors can be connected in parallel to a line. However, caution this time, each sensor's ID to be different, continuous data read (# READ) instruction, such as ID and to answer all the sensors, regardless of instruction should not be used. And when you use multiple sensors to allow sufficient power supply wiring should be designed.

Pic 4.1 Cable Index

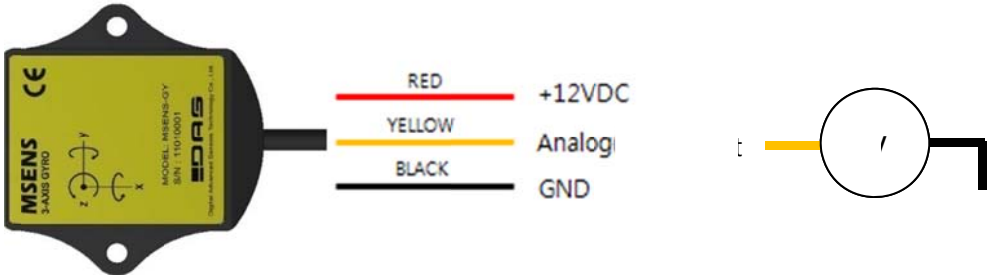


Pic 4.2 RS-485 Parallel connection diagram

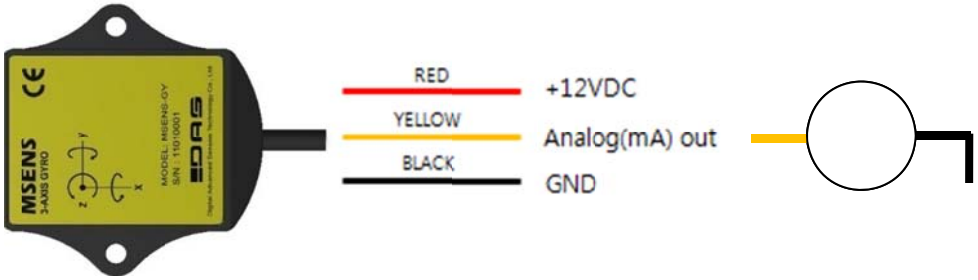
4 - 2 Analog Wiring

The analog output is voltage(default) or current output.

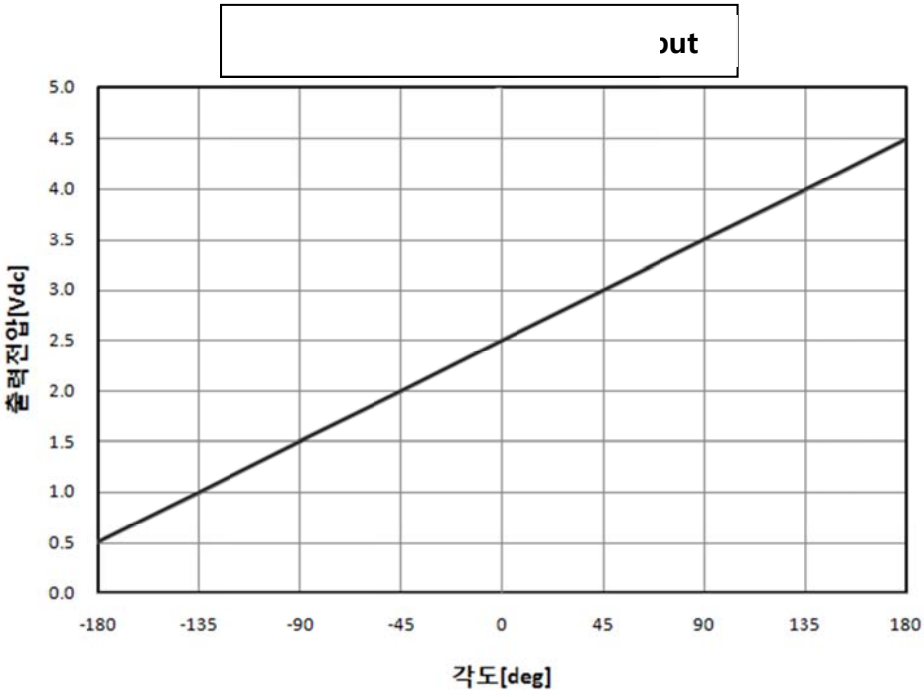
Output axis of analog is changed by user command. The default output axis is Yaw.



Pic 4.3 3 Analog of voltage wiring



Pic 4.4 Analog of current wiring



5 MSENS-GY Communication Commands

First of all the transfer of 'CR' will be sent by appending.
Example> In case ID = 1 , MODE = 0,
Send format : <1 Command> + Check-sum + CR
Receive format : [1 0 "Pich""Roll""Yaw"] + Check-sum + CR

Example of calculation checksum)
<1 START> = '<' XOR '1' XOR '' XOR 'S' XOR 'T' XOR 'A' XOR 'R' XOR 'T' XOR '>'
= CHECK_SUM

	Command	Echo CMD	VALUE	Function	Data output
데이터출력	**<1>**	**x**	**x**	1time data	**[1 0 1234 45 4567]**
	<1 START>	**[1 START]**	**x**	Continues data	**[1 0 1234 45 4567]**
	<1 STOP>	**[1 STOP]**	**x**	Stop output	
설정명령어	**<1 ID 254>**	**[1 ID 254]**	**1~254**	ID Change	
	<1 SPEED 1>	**[1 SPEED 0]**	**1, 2, 3**	baudrate	
	<1 MODE 0>	**[1 MODE 0]**	**Angle:0, angular velocity :1**	MODE change	
	<1 SCALE 1>	**[1 SCALE 1]**	**GY: 1,2,8 AC: 2,4,8**	Full Scale Setting	
	<1 ANALOG 2>	**[1 ANALOG 2]**	**X:0, Y:1, Z:2**	Analog 출력 축 설정	
	<1 OFFSET 3.5>	**[1 OFFSET 3.5]**	**Voltage(mV)**	Analog output axis offset	
	<1 SPAN 1.05>	**[1 SPAN 1.05]**	**Scale Factor**	Analog output span	
	<1 CALI>	**[1 CALI 12 34 56] x**		Gyro Bias Calibration	
	<1 INIT>	**[1 INIT]**	**x**	Set to YAW 0	
	<1 SAVE>	**[1 SAVE]**	**x**	Save Setting	
	<1 RESTORE>	**[1 RESTORE]**	**x**	Default setting values return	
	<1 VER>	**[1 VER MSENS-GY 01.00] x**		Version information	

Table 5.1 Command

5 - 1 One-time data output

COMMAND	<1>
Function	One-time data output
Example (id=1)	<1>
Echo	없음
Output	[1 0 1234 45 1923]

Attention) All of following example is for ID 1, MODE 1.

Mode '0'

Output data is applied Kalman filler. It is good for slow measurement and more correct value.

Unit is mg/DIGIT. ex) 1234 = 1234 mg = 1.234 g

[10123445 1923] ←ID=1, MODE=0, X=1234, Y=45, Z=1923

Mode '1'

Output data is not applied Kalman filler. It is good for fast and more roughly measurement.

Unit is mg/DIGIT ex) 1234 = 1234 mg = 1.234 g

Output is include scale value.

[1 11 522 2345 1253]← ID=1, MODE=1 ,SCALE=1,X=522, Y=2345, Z=1253

(Attention) When the Mode is '1', output interval is 10msec.

5 - 2 Continuously data output

COMMAND	<1 START>
Function	Continuously data output
Example (id=1)	<1 START>
Echo	[1 START]
Output(mode=0)	[1 0 1234 45 1923]

After send command, send the save command. If don't send save command, lost command when turn off.

Attention) Do not send 'START' command to more 2 device with RS485.

5 - 3 Stop data output

COMMAND	<1 STOP>
Function	Stop data output
Example (id=1)	<1 STOP>
Echo	[1 STOP]

If output speed is high, Send 'STOP' command several times until data output is stop.

5 - 4 ID Setting

COMMAND	<1 ID "New ID">
Function	ID Setting and check
Default	1
Example (new id=123)	<1 ID 123>
Echo	[1 ID 123]

MSENS-GY has own ID number (1~254). Default ID number is '1'.

You want know ID number, do following
Connect to pc on RS45
and send <0>. The return value is ID,, MODE , X,Y,Z.

[1 0 1234 45 1923]
It mean is ID=1 , MODE=0, X=1234, Y=45, Z=1923

(Attention) After send command, send the save command. If don't send save command, lost command when turn off.

5 - 5 Data output type setting

COMMAND	<1 MODE "VALUE">
Function	Data output type setting
Value	0 , 1
Default	0
Example (new MODE=1)	<1 MODE1>
Echo	[1 MODE1]

It is setting data output type and check.
Default value of MODE is '0'

MODE 0 : Output data is applied Kalman filler. It is good for slow measurement and more correct value.
MODE 1 : Output data is not applied Kalman filler. It is good for fast and more roughly measurement.

If you wand know what is the set MODE, Send <1 MODE>. Then return value is [1 MODE 0]. It mean is MODE 0.

5 - 6 Full Scale Setting

COMMAND	<1 SCALE "VALUE">
Function	Full Scale Setting
Value	1, 2, 8
Default	1
Example (NEW SCALE=8)	<1 SCALE 8>
Echo	[1 SCALE 8]

It is to set full scale of gyro sensor and check.

SCALE	DPS
1	±250
2	±500
8	±2000

Default value is 1(±250 DPS)

If you want know what is SCALE value, send <1 SCALE>
Return value is [1 SCALE 8]. It means the scale value is 8(±2000 DPS)

Output unit is always mdps.

5 - 7 Data output interval

COMMAND	<1 INTERVAL "VALUE">
Function	Data output interval
Value	10 ~ 1000
Default	100
Example (INTERVAL=10mS)	<1 INTERVAL 10>
Echo	[1 INTERVAL 10]

It is setting data output interval and check.
The setting unit is msec. Range is from 10[msec] to 1000[msec].
Setting step is 10[msec].
Default value is 100 [msec.

But, interval is only 10[msec] when MODE 1.
Send Command : <1 INTERVAL>
Return value : [1 INTERVAL 10] It mean is 10[msec].

5 - 8 Baudrate of serial

COMMAND	<1 SPEED "VALUE">
Function	RS485 Baudrate of serial
Value	1, 2, 3
Default	1
Example (SPEED=2)	<1 SPEED 2>
Echo	[1 SPEED 2]

It is setting baudrate of RS485 and check..
Default value is Baudrate:115200, Data bit:8, Stop bit:1, parity:None

SPEED	BAUD RATE
1	115200
2	57600
3	38400

If you wand know what is baudrate value, send <1 SPEED >.
Return value is [1 SPEED 1]. It mean is 115200(baudrate is 115200).

5 - 9 Axis of analog output setting

COMMAND	<1 ANALOG "VALUE">
Function	Axis of analog output setting
Value	0, 1, 2
Default	2
Example (ANALOG=0)	<1 ANALOG 0>
Echo	[1 ANALOG 0]

It is setting axis of analog output and check.
Default value is 2(Yaw axis).

ANALOG	AXIS
0	X (ROLL),
1	Y (PITCH)
2	Z (YAW)

If you want know what is output axis of analog. Send <1 ANALOG>.
Return value is [1 ANALOG 0].

- Analog value is deferent depend on FULL SCALE.
  ±2g : -2g : 0.5V, 0g : 2.5V, +2g : 4.5V 출력.
  ±8g : -8g : 0.5V, 0g : 2.5V, +8g : 4.5V 출력

4~20 mA : 0.5V = 5.6 mA, 2.5V = 12 mA, 4.5V = 18.4 mA

5 - 1 0 Analog output offset setting

COMMAND	<1 OFFSET"VALUE">
Function	Analog output offset setting
Value	Real
Default	0
Example (OFFSET=3.5)	<1 OFFSET 3.5>
Echo	[1 OFFSET 3.5]

It is setting for analog output offset and check.
Default value is 0[mV].
It has two kind of type. One of them is voltage, other one is current. It is setting by order made. Default is voltage.

If sensor is current output type and setting value is 1, output is change to 3.2uA up.
Example) <1 OFFSET 3.5>← 3,5mV up.
<1 OFFSET -12.5>← -12.5mV down.
If you want know what is offset setting value, send <1 OFFSET>.
Return value is [1 OFFSET -12.5]. It means offset setting value is -12.5 mV.

5 - 1 1 Span of analog output setting

COMMAND	<1 SPAN"VALUE">
Function	Span of analog output setting
Value	Real
Default	1
Example (SPAN=1.00452)	<1 SPAN1.00452>
Echo	[1 SPAN1.00452]

It is setting for span of analog (mV or mA) output and check.
Default value is 1.

Example)
<1 SPAN 1.00452>← Voltage output is FULL SCALE * 1.00452
<1 SPAN 0.9987>← Voltage output is FULL SCALE * 0.9987
If you wand know what is SPAN setting value, Send <1 SPAN.
Return value is [1 SPAN0.9987

5 - 1 2 GyroBiasCalibration

COMMAND	<1 CALI >
Function	Gyro Bias Calibration
Example	<1 CALI>
응 답	[1 CALI 123 24 43]

It is to calibration for bias of core gyro sensor
It needs about one second.
Do not change except if you know this function well.

Return value is [1 CALI123 24 43]. It means X-bias : 123 , Y-bias : 23 , Z-bias : 43

5 - 1 3 Z(Yaw) 0 Degree Initial Setting

COMMAND	<1 INIT>
Function	1 - 1 Z(Yaw) 0 Degree Initial Setting
Example	<1 INIT>
Echo	[1 INIT]

It is to change the value of angle of Yaw to 0.
It is same that the blue-line is connected red-line(+V) very sort time.

5 - 1 4 Save setting values

COMMAND	<1 SAVE>
Function	Save setting values
Example	<1 SAVE>
Echo	[1 SAVE]

It is to save to EEPROM setting values.

5 - 1 5 Conform the S/W version

COMMAND	<1 VER>
Function	Conform the S/W version
Example	<1 VER>
응 답	[1 VER MSENS-GY 01.00]

If you want know what is S/W version, send <1 VER>
Return value is [1 VER MSENS-AC 01.0].

5 - 1 6 Return all setting values to default

COMMAND	<1 RESTORE>
Function	Return all setting values to default
Example	<1 RESTORE>
Echo	[1 RESTORE]

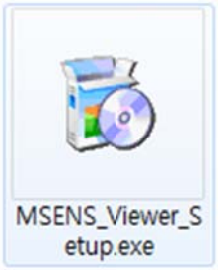
All setting values in EEPROM are return to default except baudrate.

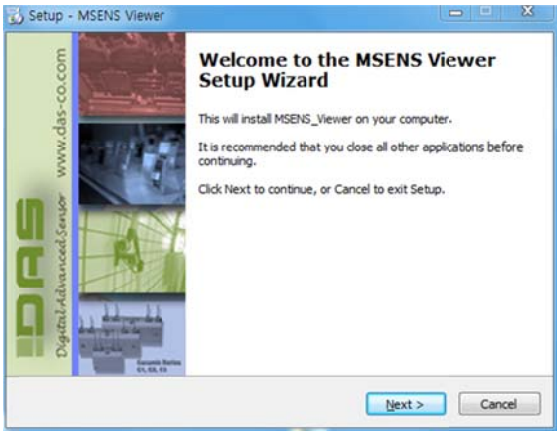
6 Install PC Program

6 - 1 Download pc program

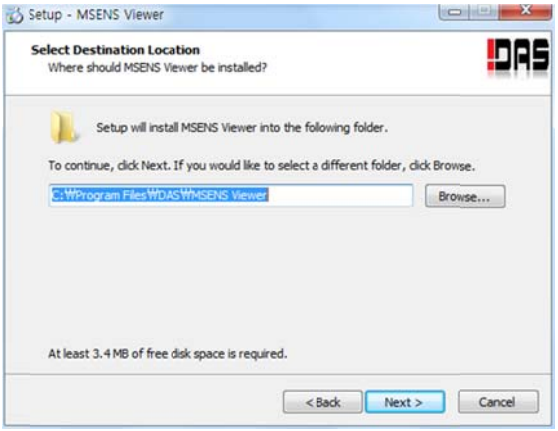
The setup program is technical board of website(http://www.das-co.com).

6 - 2 Install





- Double click the icon of setup.



- Input the install path.

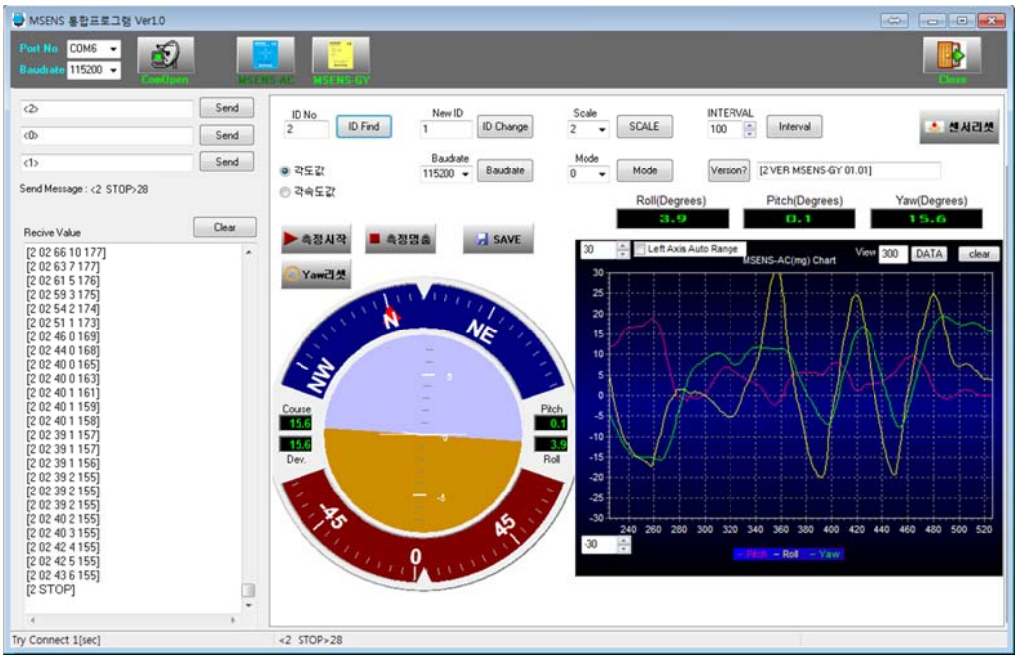
- Finish

7 MSENS-Viewer Main window

7 - 1 MAIN

- MSENS-AC

- MSENS-GY



If you want more information about program, please see the manual of MSENS-Viewer.

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