

DeltaRobot
v0.4

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Chapter 1

Main Page

This project is a Delta robot controller using Dynamixel [AX12](#) servos. This type of robot can pick and place objects

Chapter 2

Namespace Documentation

2.1 Ui Namespace Reference

Namespace to work with a User Interface Qt Form.

2.1.1 Detailed Description

Namespace to work with a User Interface Qt Form.

Chapter 3

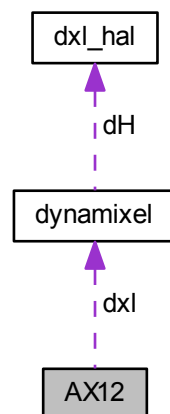
Class Documentation

3.1 AX12 Class Reference

The [AX12](#) class is used to control AX-12 motors from Dynamixel.

```
#include <ax12.h>
```

Collaboration diagram for AX12:



Public Member Functions

- [AX12](#) ([dynamixel](#) *dxl, int ID=-1)
Default constructor must pass an initialized dynamixel object if ID == -1 no action is done.
- [AX12](#) (const [AX12](#) &a)
Copy constructor.
- [~AX12](#) ()
Default destructor.
- QVector< int > [connectedID](#) ()
Returns all active servos;.
- double [getCurrentLoad](#) ()

- Returns the current load from -100% to 100%, 100% is ClockWise and -100% is CounterClockWise.*
- double [getCurrentPos](#) ()
Returns the current position from 0° to 300°
- int [getCurrentTemp](#) ()
Returns the current Temperature in Celsius.
- double [getCurrentSpeed](#) ()
Returns the current speed from -100% to 100%, 100% is ClockWise and -100% is CounterClockWise.
- double [getCurrentVoltage](#) ()
Returns the current voltage in Volts.
- int [getID](#) ()
To get the current ID.
- void [setGoalPosition](#) (double goal)
Sets the Goal's position (in degrees) or speed depending on the mode.
- void [setID](#) (int ID)
To set a new ID.
- void [setJointMode](#) (bool mode)
To set Joint/Wheel mode, true if Joint.
- void [setMinMax](#) (double min, double max)
To set the minimum and maximum angle from 0 to 300°
- void [setSpeed](#) (double speed)
To set the maximum speed from 0% to 100% if joint mode or from -100% to 100% if wheel mode.

Private Types

- enum [ROM](#) {
[ModelNumber](#) = 0, [VersionFirmware](#) = 2, [ID](#) = 3, [BaudRate](#) = 4,
[ReturnDelayTime](#) = 5, [CWAngleLimit](#) = 6, [CCWAngleLimit](#) = 8, [HighestLimitTemp](#) = 11,
[LowestLimitVoltage](#) = 12, [HighestLimitVoltage](#) = 13, [MaxTorque](#) = 14, [StatusReturnLevel](#) = 16,
[AlarmLED](#) = 17, [AlarmShutdown](#) = 18 }
Contains all the EEPROM directions enumeration.
- enum [RAM](#) {
[TorqueEnable](#) = 24, [LED](#) = 25, [CWComplianceMargin](#) = 26, [CCWComplianceMargin](#) = 27,
[CWComplianceSlope](#) = 28, [CCWComplianceSlope](#) = 29, [GoalPosition](#) = 30, [MovingSpeed](#) = 32,
[TorqueLimit](#) = 34, [PresentPosition](#) = 36, [PresentSpeed](#) = 38, [PresentLoad](#) = 40,
[PresentVoltage](#) = 42, [PresentTemperature](#) = 43, [Registered](#) = 44, [Moving](#) = 46,
[Lock](#) = 47, [Punch](#) = 48 }
Contains all the RAM directions enumerations.

Private Attributes

- [dynamixel](#) * [dxl](#)
Contains the dynamixel communication.
- int [_ID](#)
Stores the current ID.
- bool [_mode](#)
True if we use the joint mode.
- bool [_rads](#)
True if the angle is returned in radians.

3.1.1 Detailed Description

The [AX12](#) class is used to control AX-12 motors from Dynamixel.

3.1.2 Member Enumeration Documentation

3.1.2.1 enum AX12::RAM [private]

Contains all the RAM directions enumerations.

Enumerator

TorqueEnable
LED
CWComplianceMargin
CCWComplianceMargin
CWComplianceSlope
CCWComplianceSlope
GoalPosition
MovingSpeed
TorqueLimit
PresentPosition
PresentSpeed
PresentLoad
PresentVoltage
PresentTemperature
Registered
Moving
Lock
Punch

```

00044    {
00045        TorqueEnable    = 24,
00046        LED            = 25,
00047        CWComplianceMargin = 26,
00048        CCWComplianceMargin = 27,
00049        CWComplianceSlope = 28,
00050        CCWComplianceSlope = 29,
00051        GoalPosition    = 30,
00052        MovingSpeed     = 32,
00053        TorqueLimit     = 34,
00054        PresentPosition = 36,
00055        PresentSpeed    = 38,
00056        PresentLoad    = 40,
00057        PresentVoltage  = 42,
00058        PresentTemperature = 43,
00059        Registered     = 44,
00060        Moving         = 46,
00061        Lock           = 47,
00062        Punch          = 48
00063    };
00064

```

3.1.2.2 enum AX12::ROM [private]

Contains all the EEPROM directions enumeration.

Enumerator

ModelNumber
VersionFirmware
ID

BaudRate
ReturnDelayTime
CWAngleLimit
CCWAngleLimit
HighestLimitTemp
LowestLimitVoltage
HighestLimitVoltage
MaxTorque
StatusReturnLevel
AlarmLED
AlarmShutdown

```

00025     {
00026         ModelNumber      = 0,
00027         VersionFirmware  = 2,
00028         ID                = 3,
00029         BaudRate          = 4,
00030         ReturnDelayTime  = 5,
00031         CWAngleLimit      = 6,
00032         CCWAngleLimit     = 8,
00033         HighestLimitTemp  = 11,
00034         LowestLimitVoltage = 12,
00035         HighestLimitVoltage = 13,
00036         MaxTorque         = 14,
00037         StatusReturnLevel = 16,
00038         AlarmLED          = 17,
00039         AlarmShutdown     = 18
00040     };

```

3.1.3 Constructor & Destructor Documentation

3.1.3.1 AX12::AX12 (dynamixel * dxl, int ID = -1)

Default constructor must pass an initialized dynamixel object if ID == -1 no action is done.

```

00005                                     :
00006         dxl (dxl),
00007         _ID (ID),
00008         _mode (true),
00009         _rads (false)
00010     {
00011         if (_ID < 0) return;
00012         dxl->write_byte(_ID, RAM::TorqueEnable, true);
00013     }

```

3.1.3.2 AX12::AX12 (const AX12 & a)

Copy constructor.

```

00015                                     :
00016         dxl (a.dxl),
00017         _ID (a._ID),
00018         _mode (a._mode),
00019         _rads (a._rads)
00020     {
00021
00022     }

```

3.1.3.3 AX12::~AX12 ()

Default destructor.

```

00025 {
00026
00027 }

```

3.1.4 Member Function Documentation

3.1.4.1 QVector< int > AX12::connectedID ()

Returns all active servos;

```
00030 {
00031     QVector<int> res;
00032     for (int i = 0; i < 256; ++i) {
00033         dxl->ping(i);
00034         if (dxl->get_comm_result() == COMM_RXSUCCESS) res.push_back(i);
00035     }
00036
00037     return res;
00038 }
```

3.1.4.2 double AX12::getCurrentLoad ()

Returns the current load from -100% to 100%, 100% is ClockWise and -100% is CounterClockWise.

```
00041 {
00042     if (_ID < 0) return 0;
00043     int load = dxl->read_word(_ID, RAM::PresentLoad);
00044     load -= 1024;
00045     if (load == -1024) load = 0;
00046     return double((load/1023)*100);
00047 }
```

3.1.4.3 double AX12::getCurrentPos ()

Returns the current position from 0° to 300°

```
00050 {
00051     if (_ID < 0) return 0;
00052     int pos = dxl->read_word(_ID, RAM::PresentPosition);
00053     if (dxl->get_comm_result() != COMM_RXSUCCESS) return -1;
00054
00055     if (_rads) return double((pos/1023.0)*5*M_PI/3);
00056     return double((pos/1023.0)*300);
00057 }
```

3.1.4.4 double AX12::getCurrentSpeed ()

Returns the current speed from -100% to 100%, 100% is ClockWise and -100% is CounterClockWise.

```
00068 {
00069     if (_ID < 0) return 0;
00070     int speed = dxl->read_word(_ID, RAM::PresentSpeed);
00071     if (dxl->get_comm_result() != COMM_RXSUCCESS) return -1;
00072     speed -= 1024;
00073     if (speed == -1024) speed = 0;
00074     return double((speed/1023.0)*100);
00075 }
```

3.1.4.5 int AX12::getCurrentTemp ()

Returns the current Temperature in Celsius.

```
00060 {
00061     if (_ID < 0) return 0;
00062     int temp = dxl->read_byte(_ID, RAM::PresentTemperature);
00063     if (dxl->get_comm_result() != COMM_RXSUCCESS) return -1;
00064     return temp;
00065 }
```

3.1.4.6 double AX12::getCurrentVoltage ()

Returns the current voltage in Volts.

```
00078 {
00079     if (_ID < 0) return 0;
00080     char voltage = dxl->read_byte(_ID, RAM::PresentVoltage);
00081     if (dxl->get_comm_result() != COMM_RXSUCCESS) return -1;
00082     return double(voltage/10.0);
00083 }
```

3.1.4.7 int AX12::getID () [inline]

To get the current ID.

```
00111 { return _ID; }
```

3.1.4.8 void AX12::setGoalPosition (double goal)

Sets the Goal's position (in degrees) or speed depending on the mode.

```
00086 {
00087     if (_ID < 0) return;
00088     if (goal > 300.0) goal = 300.0;
00089     else if (goal < 0) goal = 0;
00090     dxl->write_word(_ID, RAM::GoalPosition, int((goal/300.0)*1023));
00091 }
```

3.1.4.9 void AX12::setID (int ID)

To set a new ID.

```
00094 {
00095     _ID = ID;
00096     if (ID < 0) return;
00097     dxl->write_byte(_ID, RAM::TorqueEnable, true);
00098 }
```

3.1.4.10 void AX12::setJointMode (bool mode)

To set Joint/Wheel mode, true if Joint.

```
00101 {
00102     if (_ID < 0) return;
00103     _mode = mode;
00104     if (_mode) {
00105         dxl->write_word(_ID, ROM::CWAngleLimit, 0);
00106         dxl->write_word(_ID, ROM::CCWAngleLimit, 1023);
00107     }
00108     else {
00109         dxl->write_word(_ID, ROM::CWAngleLimit, 0);
00110         dxl->write_word(_ID, ROM::CCWAngleLimit, 0);
00111     }
00112 }
```

3.1.4.11 void AX12::setMinMax (double *min*, double *max*)

To set the minimum and maximum angle from 0 to 300°

```

00115 {
00116     if (_ID < 0) return;
00117
00118     if (min > max) std::swap(min, max);
00119
00120     if (min < 0.0) min = 0;
00121     if (max > 300.0) max = 300;
00122
00123     min = (min/300)*1023;
00124     max = (max/300)*1023;
00125
00126     dxl->write_word(_ID, ROM::CWAngleLimit, int (min));
00127     dxl->write_word(_ID, ROM::CCWAngleLimit, int (max));
00128 }
```

3.1.4.12 void AX12::setSpeed (double *speed*)

To set the maximum speed from 0% to 100% if joint mode or from -100% to 100% if wheel mode.

```

00131 {
00132     if (_ID < 0) return;
00133     if (speed > 100.0) speed = 100.0;
00134     if (_mode) {
00135         if (speed < 0.0) speed = 0.0;
00136
00137         int byte = int((speed/100.0) * 1024.0);
00138         if (speed == 100.0) byte = 0;
00139         dxl->write_byte(_ID, RAM::MovingSpeed, byte);
00140     }
00141     else {
00142         if (speed < -100.0) speed = -100.0;
00143
00144         int byte = int(((speed + 100)/100.0) * 1024);
00145         dxl->write_byte(_ID, RAM::MovingSpeed, byte);
00146     }
00147 }
00148 }
```

3.1.5 Member Data Documentation

3.1.5.1 int AX12::_ID [private]

Stores the current ID.

3.1.5.2 bool AX12::_mode [private]

True if we use the joint mode.

3.1.5.3 bool AX12::_rads [private]

True if the angle is returned in radians.

3.1.5.4 dynamixel* AX12::dxl [private]

Contains the dynamixel communication.

The documentation for this class was generated from the following files:

- [dxl/ax12.h](#)
- [dxl/ax12.cpp](#)

3.2 dynamixel2::data Struct Reference

Struct used to handle dynamixel data.

Public Attributes

- unsigned char [iID](#)
- unsigned int [iStartAddr](#)
- unsigned short [iLength](#)
- unsigned char [iError](#)
- unsigned char * [pucTable](#)

3.2.1 Detailed Description

Struct used to handle dynamixel data.

3.2.2 Member Data Documentation

3.2.2.1 unsigned char dynamixel2::data::iError

3.2.2.2 unsigned char dynamixel2::data::iID

3.2.2.3 unsigned short dynamixel2::data::iLength

3.2.2.4 unsigned int dynamixel2::data::iStartAddr

3.2.2.5 unsigned char* dynamixel2::data::pucTable

The documentation for this struct was generated from the following file:

- [dxl/dynamixel.h](#)

3.3 dxl_hal Class Reference

Dynamixel SDK platform dependent.

```
#include <dxl_hal.h>
```

Public Member Functions

- bool [open](#) (QString &devName, int baudrate)
- void [close](#) (void)
- void [clear](#) (void)
- int [change_baudrate](#) (float baudrate)
- int [write](#) (unsigned char *pPacket, int numPacket)
- int [read](#) (unsigned char *pPacket, int numPacket)
- double [get_curr_time](#) ()
- bool [isOpen](#) ()

Private Attributes

- QSerialPort `_serial`
- int `_time` = 30
- bool `_timed` = false
- bool `_open` = false

3.3.1 Detailed Description

Dynamixel SDK platform dependent.

3.3.2 Member Function Documentation

3.3.2.1 int dxl_hal::change_baudrate (float *baudrate*)

```
00039 {
00040     bool res = _serial.setBaudRate(qint32(baudrate));
00041     return int(res);
00042 }
00043 }
```

3.3.2.2 void dxl_hal::clear (void)

```
00032 {
00033     // Clear communication buffer
00034     _serial.clear();
00035 }
00036 }
```

3.3.2.3 void dxl_hal::close (void)

```
00025 {
00026     // Closing device
00027     _serial.close();
00028     _open = false;
00029 }
```

3.3.2.4 double dxl_hal::get_curr_time ()

```
00080 {
00081     return (double)QTime::currentTime().msecsSinceStartOfDay();
00082 }
```

3.3.2.5 bool dxl_hal::isOpen () [inline]

```
00030 { return _open; }
```

3.3.2.6 bool dxl_hal::open (QString & *devName*, int *baudrate*)

```
00007 {
00008     // Opening device
00009     // devIndex: Device index
00010     // baudrate: Real baudrate (ex> 115200, 57600, 38400...)
00011     // Return: 0 (Failed), 1 (Succeed)
00012
00013     _serial.setPortName(devName);
00014     _serial.setBaudRate(qint32(baudrate));
00015     _serial.setDataBits(QSerialPort::Data8);
```

```

00016     _serial.setParity(QSerialPort::NoParity);
00017     _serial.setStopBits(QSerialPort::OneStop);
00018     _serial.setFlowControl(QSerialPort::NoFlowControl);
00019     if(not _serial.open(QIODevice::ReadWrite)) return false;
00020     _open = true;
00021     return true;
00022 }

```

3.3.2.7 int dxl_hal::read (unsigned char * pPacket, int numPacket)

```

00063 {
00064     // Recieving date
00065     // *pPacket: data array pointer
00066     // numPacket: number of data array
00067     // Return: number of data recieved. -1 is error.
00068     _timed = false;
00069     if (_serial.isOpen()) {
00070         int n = _serial.read((char*)pPacket, numPacket);
00071         _timed = _serial.waitForReadyRead(_time);
00072         _timed = not _timed;
00073         return n;
00074     }
00075     else return -1;
00076 }
00077 }

```

3.3.2.8 int dxl_hal::write (unsigned char * pPacket, int numPacket)

```

00046 {
00047     // Transmitting date
00048     // *pPacket: data array pointer
00049     // numPacket: number of data array
00050     // Return: number of data transmitted. -1 is error.
00051     _timed = false;
00052     if (_serial.isOpen()) {
00053         int n = _serial.write((char*)pPacket, numPacket);
00054         _timed = _serial.waitForBytesWritten(_time);
00055         _timed = not _timed;
00056         return n;
00057     }
00058     else return -1;
00059 }
00060 }

```

3.3.3 Member Data Documentation

3.3.3.1 bool dxl_hal::_open = false [private]

3.3.3.2 QSerialPort dxl_hal::_serial [private]

3.3.3.3 int dxl_hal::_time = 30 [private]

3.3.3.4 bool dxl_hal::_timed = false [private]

The documentation for this class was generated from the following files:

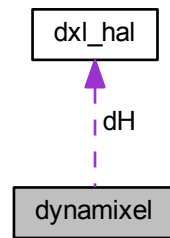
- [dxl/dxl_hal.h](#)
- [dxl/dxl_hal.cpp](#)

3.4 dynamixel Class Reference

Dynamixel 1.0 protocol class.

```
#include <dynamixel.h>
```

Collaboration diagram for dynamixel:



Public Member Functions

- [dynamixel](#) ()
- [dynamixel](#) (QString port_num, int baud_rate=1000000)
- [bool isOpen](#) ()
- [int initialize](#) (QString port_num, int baud_rate)
- [int change_baudrate](#) (int baud_rate)
- [int terminate](#) (void)
- [int get_comm_result](#) ()
- [void tx_packet](#) (void)
- [void rx_packet](#) (void)
- [void txrx_packet](#) (void)
- [void set_txpacket_id](#) (int id)
- [void set_txpacket_instruction](#) (int instruction)
- [void set_txpacket_parameter](#) (int index, int value)
- [void set_txpacket_length](#) (int length)
- [int get_rxpacket_error](#) (int error)
- [int get_rxpacket_error_byte](#) (void)
- [int get_rxpacket_parameter](#) (int index)
- [int get_rxpacket_length](#) ()
- [void ping](#) (int id)
- [int read_byte](#) (int id, int address)
- [void write_byte](#) (int id, int address, int value)
- [int read_word](#) (int id, int address)
- [void write_word](#) (int id, int address, int value)
- [double get_packet_time](#) ()
- [void set_packet_timeout](#) (int NumRcvByte)
- [void set_packet_timeout_ms](#) (int msec)
- [int is_packet_timeout](#) ()

Private Attributes

- [dxl_hal dH](#)
- [unsigned char gbInstructionPacket](#) [MAXNUM_TXPACKET] = {0}
- [unsigned char gbStatusPacket](#) [MAXNUM_RXPACKET] = {0}
- [unsigned int gbRxPacketLength](#) = 0
- [unsigned int gbRxGetLength](#) = 0

- double `gdPacketStartTime` = 0.0
- double `gdByteTransTime` = 0.0
- double `gdRcvWaitTime` = 0.0
- int `gbCommStatus` = `COMM_RXSUCCESS`
- int `giBusUsing` = 0

3.4.1 Detailed Description

Dynamixel 1.0 protocol class.

3.4.2 Constructor & Destructor Documentation

3.4.2.1 `dynamixel::dynamixel ()`

```
00014 {
00015
00016 }
```

3.4.2.2 `dynamixel::dynamixel (QString port_num, int baud_rate = 1000000)`

```
00019 {
00020     initialize(port_num, baud_rate);
00021 }
```

3.4.3 Member Function Documentation

3.4.3.1 `int dynamixel::change_baudrate (int baud_rate)`

```
00039 {
00040     int result = 0;
00041     float baudrate = (float)baud_rate;
00042
00043     result = dH.change_baudrate(baudrate);
00044     if(result == 1)
00045         gdByteTransTime = 1000.0f / baudrate * 10.0; // 1000/baudrate(bit per msec) *
10(start bit + data bit + stop bit)
00046
00047     return result;
00048 }
```

3.4.3.2 `int dynamixel::get_comm_result () [inline]`

```
00112 { return gbCommStatus; }
```

3.4.3.3 `double dynamixel::get_packet_time (void)`

```
00058 {
00059     double elapsed_time;
00060
00061     elapsed_time = (double)(dH.get_curr_time() -
gdPacketStartTime);
00062
00063     // Overflow
00064     if(elapsed_time < 0) gdPacketStartTime = dH.get_curr_time();
00065
00066     return elapsed_time;
00067 }
```

3.4.3.4 `int dynamixel::get_rxpacket_error (int error)`

```

00279 {
00280     if( gbStatusPacket[PRT1_PKT_ERRBIT] & (unsigned char)error )
00281         return 1;
00282
00283     return 0;
00284 }

```

3.4.3.5 `int dynamixel::get_rxpacket_error_byte (void)`

```

00287 {
00288     return gbStatusPacket[PRT1_PKT_ERRBIT];
00289 }

```

3.4.3.6 `int dynamixel::get_rxpacket_length ()`

```

00297 {
00298     return (int)gbStatusPacket[PRT1_PKT_LENGTH];
00299 }

```

3.4.3.7 `int dynamixel::get_rxpacket_parameter (int index)`

```

00292 {
00293     return (int)gbStatusPacket[PRT1_PKT_PARAMETER0+index];
00294 }

```

3.4.3.8 `int dynamixel::initialize (QString port_num, int baud_rate)`

```

00024 {
00025     if( baud_rate < 1900 ) return 0;
00026
00027     if( not dH.open(port_num, baud_rate) ) return false;
00028
00029     // 1000/baudrate(bit per msec) * 10(start bit + data bit + stop bit)
00030     gdByteTransTime = 1000.0 / (double)baud_rate * 10.0;
00031
00032     gbCommStatus = COMM_RXSUCCESS;
00033     giBusUsing = 0;
00034
00035     return true;
00036 }

```

3.4.3.9 `int dynamixel::is_packet_timeout (void)`

```

00082 {
00083     if(this->get_packet_time() > gdRcvWaitTime)
00084         return 1;
00085     return 0;
00086 }

```

3.4.3.10 `bool dynamixel::isOpen () [inline]`

```

00103 { return dH.isOpen(); }

```

3.4.3.11 void dynamixel::ping (int id)

```

00302 {
00303     while(giBusUsing);
00304
00305     gbInstructionPacket[PRT1_PKT_ID] = (unsigned char)id;
00306     gbInstructionPacket[PRT1_PKT_INSTRUCTION] =
INST_PING;
00307     gbInstructionPacket[PRT1_PKT_LENGTH] = 2;
00308
00309     txrx_packet();
00310 }

```

3.4.3.12 int dynamixel::read_byte (int id, int address)

```

00313 {
00314     while(giBusUsing);
00315
00316     gbInstructionPacket[PRT1_PKT_ID] = (unsigned char)id;
00317     gbInstructionPacket[PRT1_PKT_INSTRUCTION] =
INST_READ;
00318     gbInstructionPacket[PRT1_PKT_PARAMETER0+0] = (unsigned char)
address;
00319     gbInstructionPacket[PRT1_PKT_PARAMETER0+1] = 1;
00320     gbInstructionPacket[PRT1_PKT_LENGTH] = 4;
00321
00322     txrx_packet();
00323
00324     return (int)gbStatusPacket[PRT1_PKT_PARAMETER0];
00325 }

```

3.4.3.13 int dynamixel::read_word (int id, int address)

```

00341 {
00342     while(giBusUsing);
00343
00344     gbInstructionPacket[PRT1_PKT_ID] = (unsigned char)id;
00345     gbInstructionPacket[PRT1_PKT_INSTRUCTION] =
INST_READ;
00346     gbInstructionPacket[PRT1_PKT_PARAMETER0+0] = (unsigned char)
address;
00347     gbInstructionPacket[PRT1_PKT_PARAMETER0+1] = 2;
00348     gbInstructionPacket[PRT1_PKT_LENGTH] = 4;
00349
00350     txrx_packet();
00351
00352     return MAKEWORD((int)gbStatusPacket[
PRT1_PKT_PARAMETER0+0], (int)gbStatusPacket[
PRT1_PKT_PARAMETER0+1]);
00353 }

```

3.4.3.14 void dynamixel::rx_packet (void)

```

00152 {
00153     unsigned char i = 0, j = 0, nRead = 0;
00154     unsigned char checksum = 0;
00155
00156     if( giBusUsing == 0 )
00157         return;
00158
00159     if( gbInstructionPacket[PRT1_PKT_ID] ==
BROADCAST_ID )
00160     {
00161         gbCommStatus = COMM_RXSUCCESS;
00162         giBusUsing = 0;
00163         return;
00164     }
00165
00166     if( gbCommStatus == COMM_TXSUCCESS )
00167     {
00168         gbRxGetLength = 0;
00169         //gbRxPacketLength = 6; //minimum wait length
00170     }
00171
00172     while(1)

```

```

00173     {
00174         nRead = dH.read( &gbStatusPacket[gbRxGetLength],
00175             gbRxPacketLength - gbRxGetLength );
00176         gbRxGetLength += nRead;
00177         if(gbRxGetLength > 4)
00178             gbRxPacketLength = gbStatusPacket[
00179                 PRT1_PKT_LENGTH] + 4;
00180         if( gbRxGetLength < gbRxPacketLength )
00181         {
00182             if( is_packet_timeout() == 1 )
00183             {
00184                 if(gbRxGetLength == 0)
00185                     gbCommStatus = COMM_RXTIMEOUT;
00186                 else
00187                     gbCommStatus = COMM_RXCORRUPT;
00188                 giBusUsing = 0;
00189                 return;
00190             }
00191             gbCommStatus = COMM_RXWAITING;
00192             //return;
00193         }
00194         else
00195         {
00196             break;
00197         }
00198     }
00199     // Find packet header
00200     for( i=0; i<(gbRxGetLength-1); i++ )
00201     {
00202         if( gbStatusPacket[i] == 0xff && gbStatusPacket[i+1] == 0xff )
00203             break;
00204         else if( i == gbRxGetLength-2 && gbStatusPacket[gbRxGetLength-1] == 0xff )
00205             break;
00206         else {
00207             gbCommStatus = COMM_RXCORRUPT;
00208             return;
00209         }
00210     }
00211 }
00212
00213 if( i > 0 )
00214 {
00215     for( j=0; j<(gbRxGetLength-i); j++ )
00216         gbStatusPacket[j] = gbStatusPacket[j + i];
00217     gbRxGetLength -= i;
00218 }
00219
00220 // Check id pairing
00221 if( gbInstructionPacket[PRT1_PKT_ID] !=
00222     gbStatusPacket[PRT1_PKT_ID] )
00223 {
00224     gbCommStatus = COMM_RXCORRUPT;
00225     giBusUsing = 0;
00226     return;
00227 }
00228
00229 // Check checksum
00230 for( i=0; i<(gbStatusPacket[PRT1_PKT_LENGTH]+1); i++ )
00231     checksum += gbStatusPacket[i+2];
00232 checksum = ~checksum;
00233
00234 if( gbStatusPacket[gbStatusPacket[
00235     PRT1_PKT_LENGTH]+3] != checksum )
00236 {
00237     gbCommStatus = COMM_RXCORRUPT;
00238     giBusUsing = 0;
00239     return;
00240 }
00241 gbCommStatus = COMM_RXSUCCESS;
00242 giBusUsing = 0;
00243 }

```

3.4.3.15 void dynamixel::set_packet_timeout (int NumRcvByte)

```

00070 {
00071     gdPacketStartTime = dH.get_curr_time();
00072     gdRcvWaitTime = (gdByteTransTime*(double)NumRcvByte + 2.0*
00073         LATENCY_TIME + 2.0);
00073 }

```

3.4.3.16 void dynamixel::set_packet_timeout_ms (int msec)

```

00076 {
00077     gdPacketStartTime = dH.get_curr_time();
00078     gdRcvWaitTime = (double)msec;
00079 }

```

3.4.3.17 void dynamixel::set_txpacket_id (int id)

```

00258 {
00259     gbInstructionPacket[PRT1_PKT_ID] = (unsigned char)id;
00260 }

```

3.4.3.18 void dynamixel::set_txpacket_instruction (int instruction)

```

00263 {
00264     gbInstructionPacket[PRT1_PKT_INSTRUCTION] = (unsigned char)
instruction;
00265 }

```

3.4.3.19 void dynamixel::set_txpacket_length (int length)

```

00274 {
00275     gbInstructionPacket[PRT1_PKT_LENGTH] = (unsigned char)length;
00276 }

```

3.4.3.20 void dynamixel::set_txpacket_parameter (int index, int value)

```

00268 {
00269     gbInstructionPacket[PRT1_PKT_PARAMETER0+index] = (unsigned char)
value;
00270 }
00271 }

```

3.4.3.21 int dynamixel::terminate (void)

```

00051 {
00052     dH.close();
00053     return 0;
00054 }

```

3.4.3.22 void dynamixel::tx_packet (void)

```

00090 {
00091     unsigned char pkt_idx = 0;
00092     unsigned char TxNumByte, RealTxNumByte;
00093     unsigned char checksum = 0;
00094
00095     if( giBusUsing == 1 )
00096     {
00097         gbCommStatus = COMM_TXFAIL;
00098         return;
00099     }
00100
00101     giBusUsing = 1;
00102
00103     if( gbInstructionPacket[PRT1_PKT_INSTRUCTION] !=
INST_PING
00104         && gbInstructionPacket[PRT1_PKT_INSTRUCTION] !=
INST_READ
00105         && gbInstructionPacket[PRT1_PKT_INSTRUCTION] !=
INST_WRITE
00106         && gbInstructionPacket[PRT1_PKT_INSTRUCTION] !=

```



```

INST_REG_WRITE
00107     && gbInstructionPacket[PRT1_PKT_INSTRUCTION] !=
INST_ACTION
00108     && gbInstructionPacket[PRT1_PKT_INSTRUCTION] !=
INST_RESET
00109     && gbInstructionPacket[PRT1_PKT_INSTRUCTION] !=
INST_SYNC_WRITE )
00110     {
00111         gbCommStatus = COMM_TXERROR;
00112         giBusUsing = 0;
00113         return;
00114     }
00115
00116     gbInstructionPacket[0] = 0xff;
00117     gbInstructionPacket[1] = 0xff;
00118     for( pkt_idx = 0; pkt_idx < (gbInstructionPacket[
PRT1_PKT_LENGTH]+1); pkt_idx++ )
00119         checksum += gbInstructionPacket[pkt_idx+2];
00120     gbInstructionPacket[gbInstructionPacket[
PRT1_PKT_LENGTH]+3] = ~checksum;
00121
00122     //if( gbCommStatus == COMM_RXTIMEOUT || gbCommStatus == COMM_RXCORRUPT )
00123     //    dH.clear();
00124
00125     dH.clear();
00126
00127     TxNumByte = gbInstructionPacket[PRT1_PKT_LENGTH] + 4;
00128     RealTxNumByte = dH.write( gbInstructionPacket, TxNumByte );
00129
00130     if( TxNumByte != RealTxNumByte )
00131     {
00132         gbCommStatus = COMM_TXFAIL;
00133         giBusUsing = 0;
00134         return;
00135     }
00136
00137     if( gbInstructionPacket[PRT1_PKT_INSTRUCTION] ==
INST_READ )
00138     {
00139         gbRxPacketLength = gbInstructionPacket[
PRT1_PKT_PARAMETER0+1] + 6;
00140         set_packet_timeout( gbInstructionPacket[
PRT1_PKT_PARAMETER0+1] + 6 );
00141     }
00142     else
00143     {
00144         gbRxPacketLength = 6;
00145         set_packet_timeout( 6 );
00146     }
00147
00148     gbCommStatus = COMM_TXSUCCESS;
00149 }

```

3.4.3.23 void dynamixel::txrx_packet (void)

```

00246 {
00247     tx_packet();
00248
00249     if( gbCommStatus != COMM_TXSUCCESS )
00250         return;
00251
00252     rx_packet();
00253 }
00254

```

3.4.3.24 void dynamixel::write_byte (int id, int address, int value)

```

00328 {
00329     while(giBusUsing);
00330
00331     gbInstructionPacket[PRT1_PKT_ID] = (unsigned char)id;
00332     gbInstructionPacket[PRT1_PKT_INSTRUCTION] =
INST_WRITE;
00333     gbInstructionPacket[PRT1_PKT_PARAMETER0+0] = (unsigned char)
address;
00334     gbInstructionPacket[PRT1_PKT_PARAMETER0+1] = (unsigned char)value
;
00335     gbInstructionPacket[PRT1_PKT_LENGTH] = 4;
00336
00337     txrx_packet();

```

```
00338 }
```

3.4.3.25 void dynamixel::write_word (int id, int address, int value)

```
00356 {
00357     while(giBusUsing);
00358
00359     gbInstructionPacket[PRT1_PKT_ID] = (unsigned char)id;
00360     gbInstructionPacket[PRT1_PKT_INSTRUCTION] =
INST_WRITE;
00361     gbInstructionPacket[PRT1_PKT_PARAMETER0+0] = (unsigned char)
address;
00362     gbInstructionPacket[PRT1_PKT_PARAMETER0+1] = (unsigned char)
LOBYTE(value);
00363     gbInstructionPacket[PRT1_PKT_PARAMETER0+2] = (unsigned char)
HIBYTE(value);
00364     gbInstructionPacket[PRT1_PKT_LENGTH] = 5;
00365
00366     txrx_packet();
00367 }
```

3.4.4 Member Data Documentation

3.4.4.1 dxl_hal dynamixel::dH [private]

3.4.4.2 int dynamixel::gbCommStatus = COMM_RXSUCCESS [private]

3.4.4.3 unsigned char dynamixel::gbInstructionPacket[MAXNUM_TXPACKET] = {0} [private]

3.4.4.4 unsigned int dynamixel::gbRxGetLength = 0 [private]

3.4.4.5 unsigned int dynamixel::gbRxPacketLength = 0 [private]

3.4.4.6 unsigned char dynamixel::gbStatusPacket[MAXNUM_RXPACKET] = {0} [private]

3.4.4.7 double dynamixel::gdByteTransTime = 0.0 [private]

3.4.4.8 double dynamixel::gdPacketStartTime = 0.0 [private]

3.4.4.9 double dynamixel::gdRcvWaitTime = 0.0 [private]

3.4.4.10 int dynamixel::giBusUsing = 0 [private]

The documentation for this class was generated from the following files:

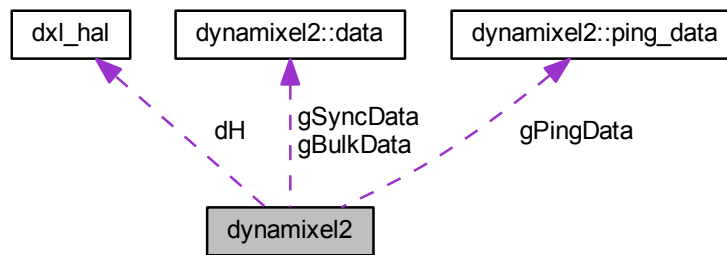
- [dxl/dynamixel.h](#)
- [dxl/dynamixel.cpp](#)

3.5 dynamixel2 Class Reference

Dynamixel 2.0 protocol class.

```
#include <dynamixel.h>
```

Collaboration diagram for dynamixel2:



Classes

- struct [data](#)
Struct used to handle dynamixel data.
- struct [ping_data](#)
Struct used to do a ping.

Public Member Functions

- bool [isOpen](#) ()
- int [initialize](#) (QString port_num, int baud_rate)
- int [change_baudrate](#) (int baud_rate)
- int [terminate](#) (void)
- int [get_comm_result](#) (void)
- void [tx_packet](#) (void)
- void [rx_packet](#) (void)
- void [txrx_packet](#) (void)
- void [set_txpacket_id](#) (unsigned char id)
- void [set_txpacket_instruction](#) (unsigned char instruction)
- void [set_txpacket_parameter](#) (unsigned short index, unsigned char value)
- void [set_txpacket_length](#) (unsigned short length)
- int [get_rxpacket_error_byte](#) (void)
- int [get_rxpacket_parameter](#) (int index)
- int [get_rxpacket_length](#) ()
- void [ping](#) (unsigned char id)
- int [get_ping_result](#) (unsigned char id, int info_num)
- void [broadcast_ping](#) ()
- void [reboot](#) (unsigned char id)
- void [factory_reset](#) (unsigned char id, int option)
- unsigned char [read_byte](#) (unsigned char id, int address)
- void [write_byte](#) (unsigned char id, int address, unsigned char value)
- unsigned short [read_word](#) (unsigned char id, int address)
- void [write_word](#) (unsigned char id, int address, unsigned short value)
- unsigned long [read_dword](#) (unsigned char id, int address)
- void [write_dword](#) (unsigned char id, int address, unsigned long value)
- unsigned char [get_bulk_read_data_byte](#) (unsigned char id, unsigned int start_address)

- unsigned short [get_bulk_read_data_word](#) (unsigned char id, unsigned int start_address)
- unsigned long [get_bulk_read_data_dword](#) (unsigned char id, unsigned int start_address)
- unsigned char [get_sync_read_data_byte](#) (unsigned char id, unsigned int start_address)
- unsigned short [get_sync_read_data_word](#) (unsigned char id, unsigned int start_address)
- unsigned long [get_sync_read_data_dword](#) (unsigned char id, unsigned int start_address)
- void [add_stuffing](#) ()
- void [remove_stuffing](#) ()
- double [get_packet_time](#) ()
- int [is_packet_timeout](#) ()
- void [set_packet_timeout](#) (int NumRcvByte)
- void [set_packet_timeout_ms](#) (int msec)

Private Types

- typedef struct [dynamixel2::ping_data](#) PingData
Struct used to do a ping.
- typedef struct [dynamixel2::data](#) SyncBulkData
Struct used to handle dynamixel data.

Private Attributes

- unsigned char [gbInstructionPacket](#) [MAXNUM_TXPACKET] = {0}
- unsigned char [gbStatusPacket](#) [MAXNUM_RXPACKET] = {0}
- unsigned int [gbRxPacketLength](#) = 0
- unsigned int [gbRxGetLength](#) = 0
- double [gdPacketStartTime](#) = 0.0
- double [gdByteTransTime](#) = 0.0
- double [gdRcvWaitTime](#) = 0.0
- int [gbCommStatus](#) = COMM_RXSUCCESS
- int [giBusUsing](#) = 0
- [dxl_hal](#) dH
- PingData [gPingData](#) [MAX_ID+1]
- SyncBulkData [gSyncData](#) [MAX_ID+1]
- SyncBulkData [gBulkData](#) [MAX_ID+1]

3.5.1 Detailed Description

Dynamixel 2.0 protocol class.

3.5.2 Member Typedef Documentation

3.5.2.1 typedef struct dynamixel2::ping_data dynamixel2::PingData [private]

Struct used to do a ping.

3.5.2.2 typedef struct dynamixel2::data dynamixel2::SyncBulkData [private]

Struct used to handle dynamixel data.

3.5.3 Member Function Documentation

3.5.3.1 void dynamixel2::add_stuffing ()

```

00524 {
00525     int i = 0, index = 0;
00526     int packet_length_in = MAKEWORD (gbInstructionPacket[
PRT2_PKT_LENGTH_L], gbInstructionPacket[
PRT2_PKT_LENGTH_H]);
00527     int packet_length_out = packet_length_in;
00528     unsigned char temp[MAXNUM_TXPACKET] = {0};
00529
00530     memcpy(temp, gbInstructionPacket, PRT2_PKT_LENGTH_H+1);    // FF FF
FD XX ID LEN_L LEN_H
00531     index = PRT2_PKT_INSTRUCTION;
00532     for( i = 0; i < packet_length_in - 2; i++)    // except CRC
00533     {
00534         if((index - 1) == MAXNUM_TXPACKET) {
00535             gbCommStatus = COMM_TXERROR;
00536             return;
00537         }
00538         temp[index++] = gbInstructionPacket[i+
PRT2_PKT_INSTRUCTION];
00539
00540         if(gbInstructionPacket[i+PRT2_PKT_INSTRUCTION] == 0xFD &&
gbInstructionPacket[i+PRT2_PKT_INSTRUCTION-1] == 0xFF &&
gbInstructionPacket[i+PRT2_PKT_INSTRUCTION-2] == 0xFF)
00541         {
00542             if((index - 1) == MAXNUM_TXPACKET) {
00543                 gbCommStatus = COMM_TXERROR;
00544                 return;
00545             }
00546             // FF FF FD
00547             temp[index++] = 0xFD;
00548
00549             packet_length_out++;
00550         }
00551     }
00552
00553     if((index - 1) == MAXNUM_TXPACKET) {
00554         gbCommStatus = COMM_TXERROR;
00555         return;
00556     }
00557     temp[index++] = gbInstructionPacket[PRT2_PKT_INSTRUCTION+
packet_length_in-2];
00558
00559     if((index - 1) == MAXNUM_TXPACKET) {
00560         gbCommStatus = COMM_TXERROR;
00561         return;
00562     }
00563     temp[index++] = gbInstructionPacket[PRT2_PKT_INSTRUCTION+
packet_length_in-1];
00564
00565     memcpy(gbInstructionPacket, temp, index);
00566     gbInstructionPacket[PRT2_PKT_LENGTH_L] =
LOBYTE(packet_length_out);
00567     gbInstructionPacket[PRT2_PKT_LENGTH_H] =
HIBYTE(packet_length_out);
00568 }

```

3.5.3.2 void dynamixel2::broadcast_ping ()

```

01049 {
01050     int idx = 0;
01051
01052     gbCommStatus = COMM_TXFAIL;
01053
01054     gbInstructionPacket[PRT2_PKT_ID] =
BROADCAST_ID;
01055     gbInstructionPacket[PRT2_PKT_LENGTH_L] = 0x03;
01056     gbInstructionPacket[PRT2_PKT_LENGTH_H] = 0x00;
01057     gbInstructionPacket[PRT2_PKT_INSTRUCTION] =
INST_PING;
01058
01059     for(idx = 1; idx <= MAX_ID; idx++)
01060     {
01061         gPingData[idx].iID = idx;
01062         gPingData[idx].iFirmVer = -1;
01063         gPingData[idx].iModelNo = -1;
01064     }
01065
01066     txrx_packet();

```

```
01067 }
```

3.5.3.3 int dynamixel2::change_baudrate (int *baud_rate*)

```
00411 {
00412     int result = 0;
00413     float baudrate = (float)baud_rate;
00414
00415     result = dH.change_baudrate(baudrate);
00416     if(result == 1)
00417         gdByteTransTime = 1000.0f / baudrate * 10.0; // 1000/baudrate(bit per msec) *
00418         10(start bit + data bit + stop bit)
00419     return result;
00420 }
```

3.5.3.4 void dynamixel2::factory_reset (unsigned char *id*, int *option*)

```
01086 {
01087     if(id == BROADCAST_ID)
01088     {
01089         gbCommStatus = COMM_TXERROR;
01090         return;
01091     }
01092
01093     gbCommStatus = COMM_TXFAIL;
01094
01095     gbInstructionPacket[PRT2_PKT_ID] = (unsigned char)id;
01096     gbInstructionPacket[PRT2_PKT_LENGTH_L] = 0x04;
01097     gbInstructionPacket[PRT2_PKT_LENGTH_H] = 0x00;
01098     gbInstructionPacket[PRT2_PKT_INSTRUCTION] =
INST_RESET;
01099     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0]
= (unsigned char)option;
01100
01101     txrx_packet();
01102 }
```

3.5.3.5 unsigned char dynamixel2::get_bulk_read_data_byte (unsigned char *id*, unsigned int *start_address*)

```
01215 {
01216     if((start_address < gBulkData[id].iStartAddr) || ((gBulkData[id].iStartAddr +
gBulkData[id].iLength-1) < start_address))
01217         return 0;
01218     return gBulkData[id].pucTable[(start_address-gBulkData[id].
iStartAddr)];
01219 }
```

3.5.3.6 unsigned long dynamixel2::get_bulk_read_data_dword (unsigned char *id*, unsigned int *start_address*)

```
01230 {
01231     if((start_address < gBulkData[id].iStartAddr) || ((gBulkData[id].iStartAddr +
gBulkData[id].iLength-1) < start_address))
01232         return 0;
01233     return MAKEWORD(MAKEWORD(gBulkData[id].pucTable[(start_address-
gBulkData[id].iStartAddr)],
01234         gBulkData[id].pucTable[(start_address-
gBulkData[id].iStartAddr+1)]),
01235         MAKEWORD(gBulkData[id].pucTable[(start_address-
gBulkData[id].iStartAddr+2)],
01236         gBulkData[id].pucTable[(start_address-
gBulkData[id].iStartAddr+3)]));
01237 }
```

3.5.3.7 unsigned short dynamixel2::get_bulk_read_data_word (unsigned char *id*, unsigned int *start_address*)

```
01222 {
01223     if( (start_address < gBulkData[id].iStartAddr) || ((gBulkData[id].iStartAddr +
```

```

        gBulkData[id].iLength-1) < start_address))
01224         return 0;
01225         return MAKEWORD(gBulkData[id].pucTable[(start_address-
        gBulkData[id].iStartAddr)],
01226                         gBulkData[id].pucTable[(start_address-gBulkData[id].iStartAddr+1)
        ]);
01227     }

```

3.5.3.8 int dynamixel2::get_comm_result (void)

3.5.3.9 double dynamixel2::get_packet_time (void)

```

00439 {
00440     double elapsed_time;
00441
00442     elapsed_time = (double) (dH.get_curr_time() -
        gdPacketStartTime);
00443
00444     // Overflow
00445     if(elapsed_time < 0)
00446         gdPacketStartTime = dH.get_curr_time();
00447
00448     return elapsed_time;
00449 }

```

3.5.3.10 int dynamixel2::get_ping_result (unsigned char id, int info_num)

```

01036 {
01037     if(id <= MAX_ID && gPingData[id].iModelNo != -1 && gPingData[id].iFirmVer != -1
        )
01038     {
01039         if(info_num == PING_INFO_MODEL_NUM )
01040             return gPingData[id].iModelNo;
01041         else if(info_num == PING_INFO_FIRM_VER)
01042             return gPingData[id].iFirmVer;
01043     }
01044
01045     return 0;
01046 }

```

3.5.3.11 int dynamixel2::get_rxpacket_error_byte (void)

```

00999 {
01000     return gbStatusPacket[PRT2_PKT_ERRBIT];
01001 }

```

3.5.3.12 int dynamixel2::get_rxpacket_length ()

```

01009 {
01010     return (int)MAKEWORD(gbStatusPacket[PRT2_PKT_LENGTH_L],
        gbStatusPacket[PRT2_PKT_LENGTH_H]);
01011 }

```

3.5.3.13 int dynamixel2::get_rxpacket_parameter (int index)

```

01004 {
01005     return (int)gbStatusPacket[PRT2_STATUS_PKT_PARAMETER0+index];
01006 }

```

3.5.3.14 unsigned char dynamixel2::get_sync_read_data_byte (unsigned char *id*, unsigned int *start_address*)

```

01240 {
01241     if((start_address < gSyncData[id].iStartAddr) || ((gSyncData[id].iStartAddr +
gSyncData[id].iLength-1) < start_address))
01242         return 0;
01243     return gBulkData[id].pucTable[ (start_address-gSyncData[id].
iStartAddr)];
01244 }
```

3.5.3.15 unsigned long dynamixel2::get_sync_read_data_dword (unsigned char *id*, unsigned int *start_address*)

```

01255 {
01256     if((start_address < gSyncData[id].iStartAddr) || ((gSyncData[id].iStartAddr +
gSyncData[id].iLength-1) < start_address))
01257         return 0;
01258     return MAKEDWORD(MAKEWORD(gSyncData[id].pucTable[ (start_address-
gSyncData[id].iStartAddr)+0],
gSyncData[id].pucTable[ (start_address-
gSyncData[id].iStartAddr)+1]),
01260     MAKEWORD(gSyncData[id].pucTable[ (start_address-
gSyncData[id].iStartAddr)+2],
gSyncData[id].pucTable[ (start_address-
gSyncData[id].iStartAddr)+3]));
01262 }
```

3.5.3.16 unsigned short dynamixel2::get_sync_read_data_word (unsigned char *id*, unsigned int *start_address*)

```

01247 {
01248     if((start_address < gSyncData[id].iStartAddr) || ((gSyncData[id].iStartAddr +
gSyncData[id].iLength-1) < start_address))
01249         return 0;
01250     return MAKEWORD(gSyncData[id].pucTable[ (start_address-
gSyncData[id].iStartAddr)],
01251     gSyncData[id].pucTable[ (start_address-gSyncData[id].iStartAddr+1)
]);
01252 }
```

3.5.3.17 int dynamixel2::initialize (QString *port_num*, int *baud_rate*)

```

00373 {
00374     unsigned int idx = 0;
00375
00376     if( baud_rate < 1900 )
00377         return 0;
00378
00379     if( dH.open(port_num, baud_rate) == 0 )
00380         return 0;
00381
00382     gdByteTransTime = 1000.0 / (double)baud_rate * 10.0; // 1000/baudrate(bit per msec) *
10(start bit + data bit + stop bit)
00383
00384
00385     for(idx = 1; idx <= MAX_ID; idx++)
00386     {
00387         gSyncData[idx].iID = idx;
00388         gSyncData[idx].iStartAddr = 1;
00389         gSyncData[idx].iLength = 1;
00390         gSyncData[idx].iError = 0;
00391         gSyncData[idx].pucTable = 0;
00392
00393         gBulkData[idx].iID = idx;
00394         gBulkData[idx].iStartAddr = 1;
00395         gBulkData[idx].iLength = 1;
00396         gBulkData[idx].iError = 0;
00397         gBulkData[idx].pucTable = 0;
00398
00399         gPingData[idx].iID = idx;
00400         gPingData[idx].iFirmVer = -1;
00401         gPingData[idx].iModelNo = -1;
00402     }
00403
00404     gbCommStatus = COMM_RXSUCCESS;
00405     giBusUsing = 0;
00406 }
```



```
00407     return 1;
00408 }
```

3.5.3.18 int dynamixel2::is_packet_timeout (void)

```
00452 {
00453     if(this->get_packet_time() > gdRcvWaitTime)
00454         return 1;
00455     return 0;
00456 }
```

3.5.3.19 bool dynamixel2::isOpen () [inline]

```
00189 { return dh.isOpen(); }
```

3.5.3.20 void dynamixel2::ping (unsigned char id)

```
01014 {
01015     gbCommStatus = COMM_TXFAIL;
01016
01017     gbInstructionPacket[PRT2_PKT_ID] = (unsigned char)id;
01018     gbInstructionPacket[PRT2_PKT_LENGTH_L] = 0x03;
01019     gbInstructionPacket[PRT2_PKT_LENGTH_H] = 0x00;
01020     gbInstructionPacket[PRT2_PKT_INSTRUCTION] =
INST_READ;
01021
01022     gPingData[id].iModelNo = -1;
01023     gPingData[id].iFirmVer = -1;
01024
01025     txrx_packet();
01026
01027     if( (id != BROADCAST_ID) && (gbCommStatus ==
COMM_RXSUCCESS) )
01028     {
01029         gPingData[id].iID = id;
01030         gPingData[id].iModelNo = MAKEWORD(
gbStatusPacket[PRT1_PKT_PARAMETER0+1],
gbStatusPacket[PRT1_PKT_PARAMETER0+2] );
01031         gPingData[id].iFirmVer = gbStatusPacket[
PRT1_PKT_PARAMETER0+3];
01032     }
01033 }
```

3.5.3.21 unsigned char dynamixel2::read_byte (unsigned char id, int address)

```
01105 {
01106     unsigned short length = 1;
01107     gbCommStatus = COMM_TXFAIL;
01108
01109     gbInstructionPacket[PRT2_PKT_ID] = id;
01110     gbInstructionPacket[PRT2_PKT_LENGTH_L] = 0x07;
01111     gbInstructionPacket[PRT2_PKT_LENGTH_H] = 0x00;
01112     gbInstructionPacket[PRT2_PKT_INSTRUCTION] =
INST_READ;
01113     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+0]
] = (unsigned char)LOBYTE(address);
01114     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+1]
] = (unsigned char)HIBYTE(address);
01115     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+2]
] = (unsigned char)LOBYTE(length);
01116     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+3]
] = (unsigned char)HIBYTE(length);
01117
01118     txrx_packet();
01119     //if(gbCommStatus == COMM_RXSUCCESS && id != BROADCAST_ID)
01120     //    memmove(data, &rxpacket[PKT_PARAMETER+1], length);
01121
01122     return gbStatusPacket[PRT2_STATUS_PKT_PARAMETER0];
01123 }
```

3.5.3.22 unsigned long dynamixel2::read_dword (unsigned char *id*, int *address*)

```

01176 {
01177     unsigned short length = 4;
01178     gbCommStatus = COMM_TXFAIL;
01179
01180     gbInstructionPacket[PRT2_PKT_ID] = id;
01181     gbInstructionPacket[PRT2_PKT_LENGTH_L] = 0x07;
01182     gbInstructionPacket[PRT2_PKT_LENGTH_H] = 0x00;
01183     gbInstructionPacket[PRT2_PKT_INSTRUCTION] =
INST_READ;
01184     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+0
] = LOBYTE(address);
01185     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+1
] = HIBYTE(address);
01186     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+2
] = LOBYTE(length);
01187     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+3
] = HIBYTE(length);
01188
01189     txrx_packet();
01190     //if(gbCommStatus == COMM_RXSUCCESS && id != BROADCAST_ID)
01191     //    memmove(data, &rxpacket[PKT_PARAMETER+1], length);
01192
01193     return MAKEDWORD(MAKEWORD ( gbStatusPacket[
PRT2_STATUS_PKT_PARAMETER0], gbStatusPacket[
PRT2_STATUS_PKT_PARAMETER0+1]),
01194     MAKEWORD ( gbStatusPacket[PRT2_STATUS_PKT_PARAMETER0+2],
gbStatusPacket[PRT2_STATUS_PKT_PARAMETER0+3]));
01195 }

```

3.5.3.23 unsigned short dynamixel2::read_word (unsigned char *id*, int *address*)

```

01140 {
01141     unsigned short length = 2;
01142     gbCommStatus = COMM_TXFAIL;
01143
01144     gbInstructionPacket[PRT2_PKT_ID] = id;
01145     gbInstructionPacket[PRT2_PKT_LENGTH_L] = 0x07;
01146     gbInstructionPacket[PRT2_PKT_LENGTH_H] = 0x00;
01147     gbInstructionPacket[PRT2_PKT_INSTRUCTION] =
INST_READ;
01148     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+0
] = LOBYTE(address);
01149     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+1
] = HIBYTE(address);
01150     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+2
] = LOBYTE(length);
01151     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+3
] = HIBYTE(length);
01152
01153     txrx_packet();
01154     //if(gbCommStatus == COMM_RXSUCCESS && id != BROADCAST_ID)
01155     //    memmove(data, &rxpacket[PKT_PARAMETER+1], length);
01156
01157     return MAKEWORD ( gbStatusPacket[
PRT2_STATUS_PKT_PARAMETER0], gbStatusPacket[
PRT2_STATUS_PKT_PARAMETER0+1]);
01158 }

```

3.5.3.24 void dynamixel2::reboot (unsigned char *id*)

```

01070 {
01071     if(id == BROADCAST_ID)
01072     {
01073         gbCommStatus = COMM_TXERROR;
01074         return;
01075     }
01076
01077     gbInstructionPacket[PRT2_PKT_ID] = (unsigned char)id;
01078     gbInstructionPacket[PRT2_PKT_LENGTH_L] = 0x03;
01079     gbInstructionPacket[PRT2_PKT_LENGTH_H] = 0x00;
01080     gbInstructionPacket[PRT2_PKT_INSTRUCTION] =
INST_REBOOT;
01081
01082     txrx_packet();
01083 }

```

3.5.3.25 void dynamixel2::remove_stuffing ()

```

00571 {
00572     int i = 0, index = 0;
00573     int packet_length_in = MAKEWORD (gbInstructionPacket[
        PRT2_PKT_LENGTH_L], gbInstructionPacket[
        PRT2_PKT_LENGTH_H]);
00574     int packet_length_out = packet_length_in;
00575
00576     index = PRT2_PKT_INSTRUCTION;
00577     for( i = 0; i < packet_length_in - 2; i++) // except CRC
00578     {
00579         if (gbInstructionPacket[i+PRT2_PKT_INSTRUCTION] == 0xFD &&
            gbInstructionPacket[i+PRT2_PKT_INSTRUCTION+1] == 0xFD &&
            gbInstructionPacket[i+PRT2_PKT_INSTRUCTION-1] == 0xFF &&
            gbInstructionPacket[i+PRT2_PKT_INSTRUCTION-2] == 0xFF)
00580         { // FF FF FD FD
00581             packet_length_out--;
00582             i++;
00583         }
00584         gbInstructionPacket[index++] = gbInstructionPacket[i+
            PRT2_PKT_INSTRUCTION];
00585     }
00586     gbInstructionPacket[index++] = gbInstructionPacket[
        PRT2_PKT_INSTRUCTION+packet_length_in-2];
00587     gbInstructionPacket[index++] = gbInstructionPacket[
        PRT2_PKT_INSTRUCTION+packet_length_in-1];
00588
00589     gbInstructionPacket[PRT2_PKT_LENGTH_L] =
        LOBYTE(packet_length_out);
00590     gbInstructionPacket[PRT2_PKT_LENGTH_H] =
        HIBYTE(packet_length_out);
00591 }

```

3.5.3.26 void dynamixel2::rx_packet (void)

```

00650 {
00651     //int rx_length = 0, wait_length = PRT2_PKT_LENGTH_H + 4 + 1; // 4 : INST ERROR CHKSUM_L CHKSUM_H
00652     unsigned int i;
00653     unsigned short crc = 0;
00654
00655     gbRxGetLength = 0; gbRxPacketLength =
        PRT2_PKT_LENGTH_H + 4 + 1;
00656
00657     // Check Bus Using
00658     //if (bus_using == 0)
00659     //    return 0;
00660
00661     while(1)
00662     {
00663         gbRxGetLength += dH.read( &gbStatusPacket[
            gbRxGetLength], gbRxPacketLength - gbRxGetLength);
00664         if (gbRxGetLength >= gbRxPacketLength) // wait_length minimum : 11
00665         {
00666             // Find packet header
00667             for(i = 0; i < (gbRxGetLength - 2); i++)
00668             {
00669                 if (gbStatusPacket[i] == 0xFF && gbStatusPacket[i+1] == 0xFF &&
                    gbStatusPacket[i+2] == 0xFD)
00670                     break;
00671             }
00672
00673             if(i == 0)
00674             {
00675                 // Check length
00676                 gbRxPacketLength = MAKEWORD(
                    gbStatusPacket[PRT2_PKT_LENGTH_L], gbStatusPacket[
                    PRT2_PKT_LENGTH_H]) + PRT2_PKT_LENGTH_H + 1;
00677                 if (gbRxGetLength < gbRxPacketLength)
00678                 {
00679                     // Check timeout
00680                     if (is_packet_timeout() == 1)
00681                     {
00682                         if (gbRxGetLength == 0)
00683                             gbCommStatus = COMM_RXTIMEOUT;
00684                         else
00685                             gbCommStatus = COMM_RXCORRUPT;
00686                         giBusUsing = 0;
00687                         break;
00688                     }
00689                     continue;
00690                 }
00691             }

```

```

00692             // Check CRC16
00693             crc = MAKEWORD( gbStatusPacket[
gbRxPacketLength-2], gbStatusPacket[
gbRxPacketLength-1]);
00694             if(update_crc(0, gbStatusPacket,
gbRxPacketLength-2) == crc) // -2 : except CRC16
00695                 gbCommStatus = COMM_RXSUCCESS;
00696             else
00697                 gbCommStatus = COMM_RXCORRUPT;
00698             giBusUsing = 0;
00699             break;
00700         }
00701     else
00702     {
00703         // Remove unnecessary packets
00704         memmove(&gbStatusPacket[0], &gbStatusPacket[i], gbRxGetLength -
i);
00705         gbRxGetLength -= i;
00706     }
00707 }
00708 else
00709 {
00710     // Check timeout
00711     if(is_packet_timeout() == 1)
00712     {
00713         if(gbRxGetLength == 0)
00714             gbCommStatus = COMM_RXTIMEOUT;
00715         else
00716             gbCommStatus = COMM_RXCORRUPT;
00717         giBusUsing = 0;
00718         break;
00719     }
00720 }
00721 }
00722
00723 // Character stuffing
00724 if(gbCommStatus == COMM_RXSUCCESS)
00725     remove_stuffing();
00726
00727 giBusUsing = 0;
00728 }

```

3.5.3.27 void dynamixel2::set_packet_timeout (int NumRcvByte)

```

00459 {
00460     gdPacketStartTime = dH.get_curr_time();
00461     gdRcvWaitTime = (gdByteTransTime*(double)NumRcvByte + 2.0*
LATENCY_TIME + 2.0);
00462 }

```

3.5.3.28 void dynamixel2::set_packet_timeout_ms (int msec)

```

00465 {
00466     gdPacketStartTime = dH.get_curr_time();
00467     gdRcvWaitTime = (double)msec;
00468 }

```

3.5.3.29 void dynamixel2::set_txpacket_id (unsigned char id)

```

00978 {
00979     gbInstructionPacket[PRT2_PKT_ID] = id;
00980 }

```

3.5.3.30 void dynamixel2::set_txpacket_instruction (unsigned char instruction)

```

00983 {
00984     gbInstructionPacket[PRT2_PKT_INSTRUCTION] = (unsigned char)
instruction;
00985 }

```

3.5.3.31 void dynamixel2::set_txpacket_length (unsigned short *length*)

```

00993 {
00994     gbInstructionPacket[PRT2_PKT_LENGTH_L] =
        LOBYTE(length);
00995     gbInstructionPacket[PRT2_PKT_LENGTH_H] =
        HIBYTE(length);
00996 }

```

3.5.3.32 void dynamixel2::set_txpacket_parameter (unsigned short *index*, unsigned char *value*)

```

00988 {
00989     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+
        index] = value;
00990 }

```

3.5.3.33 int dynamixel2::terminate (void)

```

00423 {
00424     int id = 0;
00425     for(id = 0; id <= MAX_ID; id++)
00426     {
00427         if(gBulkData[id].pucTable != 0)
00428             free((gBulkData[id].pucTable));
00429
00430         if(gSyncData[id].pucTable != 0)
00431             free((gBulkData[id].pucTable));
00432     }
00433     dH.close();
00434     return 0;
00435 }

```

3.5.3.34 void dynamixel2::tx_packet (void)

```

00595 {
00596     int packet_tx_len, real_tx_len;
00597     int length;
00598     unsigned short crc = 0;
00599
00600
00601     // Check Bus Using
00602     if(giBusUsing == 1)
00603     {
00604         gbCommStatus = COMM_TXFAIL;
00605         return;
00606     }
00607     giBusUsing = 1;
00608
00609     // Character stuffing
00610     add_stuffing();
00611     if(gbCommStatus == COMM_TXERROR)
00612         return;
00613
00614     length = MAKEWORD(gbInstructionPacket[
        PRT2_PKT_LENGTH_L], gbInstructionPacket[
        PRT2_PKT_LENGTH_H]);
00615
00616     // Check MAX packet length
00617     if(length > (MAXNUM_TXPACKET))
00618     {
00619         giBusUsing = 0;
00620         gbCommStatus = COMM_TXERROR;
00621         return;
00622     }
00623
00624     // Packet Header
00625     gbInstructionPacket[PRT2_PKT_HEADER0] = 0xFF;
00626     gbInstructionPacket[PRT2_PKT_HEADER1] = 0xFF;
00627     gbInstructionPacket[PRT2_PKT_HEADER2] = 0xFD;
00628     gbInstructionPacket[PRT2_PKT_RESERVED] = 0x00; // RESERVED
00629
00630     // Add CRC16
00631     crc = update_crc(0, gbInstructionPacket, length+
        PRT2_PKT_LENGTH_H+1-2); // -2 : except CRC16
00632     gbInstructionPacket[length+PRT2_PKT_LENGTH_H-1] =

```

```

        LOBYTE( crc );          // last - 1
00633     gbInstructionPacket[ length + PRT2_PKT_LENGTH_H - 0 ] =
        HIBYTE( crc );          // last - 0
00634
00635     // Tx Packet
00636     dH.clear();
00637     packet_tx_len = length + PRT2_PKT_LENGTH_H + 1;
00638     real_tx_len = dH.write( gbInstructionPacket, packet_tx_len );
00639     if( packet_tx_len != real_tx_len )
00640     {
00641         giBusUsing = 0;
00642         gbCommStatus = COMM_TXFAIL;
00643         return;
00644     }
00645
00646     gbCommStatus = COMM_TXSUCCESS;
00647 }

```

3.5.3.35 void dynamixel2::txrx_packet (void)

```

00731 {
00732     int n = 0, num = 0;
00733     int id = 0;
00734     int wait_length = 0;
00735     int data_length = 0;
00736     gbCommStatus = COMM_TXFAIL;
00737
00738     // Wait for Bus Idle
00739     while( giBusUsing == 1 )
00740     {
00741         //Sleep(0);
00742     }
00743
00744     if( ( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] !=
INST_READ ) &&
00745         ( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] !=
INST_WRITE ) &&
00746         ( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] !=
INST_REG_WRITE ) &&
00747         ( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] !=
INST_ACTION ) &&
00748         ( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] !=
INST_RESET ) &&
00749         ( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] !=
INST_SYNC_WRITE ) &&
00750         ( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] !=
INST_BULK_READ ) &&
00751         ( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] !=
INST_REBOOT ) &&
00752         ( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] !=
INST_STATUS ) &&
00753         ( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] !=
INST_SYNC_READ ) &&
00754         ( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] !=
INST_BULK_WRITE ) ) )
00755     {
00756         gbCommStatus = COMM_TXERROR;
00757         return;
00758     }
00759
00760
00761
00762
00763     //if( ( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] != INST_SYNC_READ ) &&
( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] != INST_BULK_READ ) )
00764     if( ( gbInstructionPacket[ PRT2_PKT_ID ] !=
BROADCAST_ID ) )
00765     {
00766         tx_packet();
00767         // Check Tx packet result
00768         if( gbCommStatus != COMM_TXSUCCESS )
00769             return;
00770
00771         // Set Rx Timeout
00772         if( gbInstructionPacket[ PRT2_PKT_INSTRUCTION ] ==
INST_READ )
00773             set_packet_timeout( MAKEWORD(
gbInstructionPacket[ PRT2_INSTRUCTION_PKT_PARAMETER0 + 2 ],
gbInstructionPacket[ PRT2_INSTRUCTION_PKT_PARAMETER0 + 3 ] ) +
11 );
00774         else
00775             set_packet_timeout( PRT2_PKT_LENGTH_H + 4 + 1 );    // 4 : INST
ERROR CHKSUM_L CHKSUM_H

```

```

00776
00777     //if (gbInstructionPacket[PRT2_PKT_ID] == BROADCAST_ID)
00778     //{
00779     //    giBusUsing = 0;
00780     //    gbCommStatus = COMM_RXSUCCESS;
00781     //    return;
00782     //}
00783
00784
00785     rx_packet();
00786     if((gbCommStatus == COMM_RXSUCCESS) && (
gbStatusPacket[PRT2_PKT_ID] != BROADCAST_ID) && (
gbInstructionPacket[PRT2_PKT_ID] != gbStatusPacket[
PRT2_PKT_ID]))
00787         rx_packet();
00788     }
00789     else
00790     {
00791         if (gbInstructionPacket[PRT2_PKT_INSTRUCTION] ==
INST_BULK_READ )
00792         {
00793             num = (MAKEWORD (gbInstructionPacket[
PRT2_PKT_LENGTH_L], gbInstructionPacket[
PRT2_PKT_LENGTH_H]) - 3 )/5;
00794             for (n = 0; n < num; n++)
00795             {
00796                 id = gbInstructionPacket[
PRT2_INSTRUCTION_PKT_PARAMETER0 + n*5];
00797                 gBulkData[id].iError = -1;
00798                 gBulkData[id].iStartAddr = MAKEWORD (
gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0 + n*5
+ 1],
00799                 gbInstructionPacket[
PRT2_INSTRUCTION_PKT_PARAMETER0 + n*5 + 2]);
00800                 gBulkData[id].iLength = MAKEWORD (
gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0 + n*5
+ 3],
00801                 gbInstructionPacket[
PRT2_INSTRUCTION_PKT_PARAMETER0 + n*5 + 4]);
00802
00803                 if (gBulkData[id].pucTable != 0)
00804                     free((gBulkData[id].pucTable));
00805
00806                 gBulkData[id].pucTable = (unsigned char*) calloc(
gbBulkData[id].iLength, sizeof(unsigned char));
00807                 wait_length += gBulkData[id].iLength + 11;
00808             }
00809
00810             while (giBusUsing == 1)
00811             {
00812                 //Sleep(0);
00813             }
00814             tx_packet();
00815             if (gbCommStatus != COMM_TXSUCCESS )
00816                 return;
00817
00818             set_packet_timeout (wait_length);
00819
00820             for (n = 0; n < num; n++)
00821             {
00822                 id = gbInstructionPacket[
PRT2_INSTRUCTION_PKT_PARAMETER0 + n*5];
00823                 // Rx packet
00824                 rx_packet();
00825                 if (gbCommStatus == COMM_RXSUCCESS)
00826                     gBulkData[id].iError = gbStatusPacket[
PRT2_PKT_ERRBIT];
00827                 // rxpacket to rxdata[id]->pucTable
00828                 memcpy(gBulkData[id].pucTable, &gbStatusPacket[
PRT2_STATUS_PKT_PARAMETER0], gBulkData[id].iLength);
00829             }
00830
00831             else if (gbInstructionPacket[PRT2_PKT_INSTRUCTION] ==
INST_SYNC_READ)
00832             {
00833                 num = (MAKEWORD (gbInstructionPacket[
PRT2_PKT_LENGTH_L], gbInstructionPacket[
PRT2_PKT_LENGTH_H]) - 3 - 4); //3 : INST CRC_L CRC_H, 4 : param0->addr_l param0->addr_h
param0->length_l param0->length_h
00834                 data_length = MAKEWORD (gbInstructionPacket[
PRT2_INSTRUCTION_PKT_PARAMETER0+2],
00835                 gbInstructionPacket[
PRT2_INSTRUCTION_PKT_PARAMETER0+3]);
00836
00837
00838                 for (n = 0; n < num; n++)
00839                 {
00840                     id = gbInstructionPacket[

```

```

    PRT2_INSTRUCTION_PKT_PARAMETER0 + 4 + n];
00841     gSyncData[id].iID = id;
00842     gSyncData[id].iStartAddr = MAKEWORD(
gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0 + 0],

00843                                     gbInstructionPacket[
PRT2_INSTRUCTION_PKT_PARAMETER0 + 1]);
00844     gSyncData[id].iError = -1;
00845     if(gSyncData[id].pucTable != 0)
00846         free((gSyncData[id].pucTable));
00847
00848     gSyncData[id].pucTable = (unsigned char *) calloc(data_length, sizeof(
unsigned char));
00849 }
00850
00851
00852     wait_length = 11 + data_length;
00853     wait_length *= num;
00854
00855     while(giBusUsing == 1);
00856
00857     tx_packet();
00858
00859     // Check Tx packet result
00860     if( gbCommStatus != COMM_TXSUCCESS )
00861         return;
00862
00863     // Set Rx Timeout (SYNK_READ)
00864     set_packet_timeout(wait_length);
00865
00866     for(n = 0; n < num; n++)
00867     {
00868         id = gbInstructionPacket[
PRT2_INSTRUCTION_PKT_PARAMETER0 + 4 + n];
00869         // Rx packet
00870         rx_packet();
00871         if(gbCommStatus == COMM_RXSUCCESS)
00872             gSyncData[id].iError = gbStatusPacket[
PRT2_PKT_ERRBIT];
00873         // rxpacket to rxdata[id]->pucTable
00874         memcpy(gSyncData[id].pucTable, &gbStatusPacket[
PRT2_STATUS_PKT_PARAMETER0], data_length);
00875     }
00876
00877     return;
00878 }
00879 else if(gbInstructionPacket[PRT2_PKT_INSTRUCTION] ==
INST_PING)
00880 {
00881     int rx_length = 0;
00882     tx_packet();
00883     if(gbCommStatus != COMM_TXSUCCESS)
00884     {
00885         giBusUsing = 0;
00886         return;
00887     }
00888
00889     wait_length = PING_STATUS_LENGTH * MAX_ID;
00890     set_packet_timeout_ms((int)((gdByteTransTime * wait_length)
+ (3 * MAX_ID) + 2 * LATENCY_TIME));
00891
00892     while(1)
00893     {
00894         int _cnt = dH.read(&gbStatusPacket[rx_length], wait_length - rx_length)
;
00895         if(_cnt > 0)
00896         {
00897             rx_length += _cnt;
00898             //printf("cnt : %d, Interval : %f / Wait time : %f\n", _cnt, get_packet_time(),
gdPacketWaitTime);
00899         }
00900         if(is_packet_timeout() == 1 || rx_length >= wait_length)
00901             break;
00902     }
00903     giBusUsing = 0;
00904
00905     if(rx_length== 0)
00906     {
00907         gbCommStatus = COMM_RXTIMEOUT;
00908         return;
00909     }
00910
00911     while(1)
00912     {
00913         int idx = 0;
00914
00915         if(rx_length < PING_STATUS_LENGTH)

```



```

00916         {
00917             gbCommStatus = COMM_RXCORRUPT;
00918             return;
00919         }
00920
00921         // find packet header
00922         while( idx < (rx_length - 2) )
00923         {
00924             if(gbStatusPacket[idx] == 0xFF &&
gbStatusPacket[idx + 1] == 0xFF && gbStatusPacket[idx + 2] == 0xFD)
00925                 break;
00926             else
00927                 idx++;
00928         }
00929
00930         if(idx == 0)
00931         {
00932             // check CRC16
00933             int crc = MAKEWORD(gbStatusPacket[
PING_STATUS_LENGTH - 2], gbStatusPacket[
PING_STATUS_LENGTH - 1]);
00934             if(update_crc(0, gbStatusPacket,
PING_STATUS_LENGTH - 2) == crc) // - 2 : except CRC16
00935             {
00936                 gPingData[gbStatusPacket[
PRT2_PKT_ID]].iID = gbStatusPacket[PRT2_PKT_ID];
00937                 gPingData[gbStatusPacket[
PRT2_PKT_ID]].iModelNo = MAKEWORD(gbStatusPacket[
PRT2_STATUS_PKT_PARAMETER0], gbStatusPacket[
PRT2_STATUS_PKT_PARAMETER0+1]);
00938                 gPingData[gbStatusPacket[
PRT2_PKT_ID]].iFirmVer = gbStatusPacket[
PRT2_STATUS_PKT_PARAMETER0+2];
00939
00940                 memcpy(&gbStatusPacket[0], &gbStatusPacket[
PING_STATUS_LENGTH], rx_length - PING_STATUS_LENGTH);
00941                 rx_length -= PING_STATUS_LENGTH;
00942             }
00943             else
00944             {
00945                 gbCommStatus = COMM_RXCORRUPT;
00946
00947                 // remove header (0xFF 0xFF 0xFD)
00948                 memcpy(&gbStatusPacket[0], &gbStatusPacket[3],
rx_length - 3);
00949                 rx_length -= 3;
00950             }
00951
00952             if(rx_length < PING_STATUS_LENGTH)
00953                 break;
00954         }
00955         else
00956         {
00957             // remove unnecessary packets
00958             memcpy(&gbStatusPacket[0], &gbStatusPacket[idx], rx_length
- idx);
00959             rx_length -= idx;
00960         }
00961     }
00962 }
00963 else // Sync_Write ans Bulk_Write
00964 {
00965     tx_packet();
00966     giBusUsing = 0;
00967     if(gbCommStatus == COMM_TXSUCCESS)
00968         gbCommStatus = COMM_RXSUCCESS;
00969     return;
00970 }
00971 }
00972 }

```

3.5.3.36 void dynamixel2::write_byte (unsigned char id, int address, unsigned char value)

```

01126 {
01127     unsigned short length = 1;
01128     gbInstructionPacket[PRT2_PKT_ID] = id;
01129     gbInstructionPacket[PRT2_PKT_LENGTH_L] =
LOBYTE(length+5);
01130     gbInstructionPacket[PRT2_PKT_LENGTH_H] =
HIBYTE(length+5);
01131     gbInstructionPacket[PRT2_PKT_INSTRUCTION] =
INST_WRITE;
01132     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+0]
= LOBYTE(address);
]

```

```

01133     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+1
    ] = HIBYTE(address);
01134     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+2
    ] = (unsigned char)value;
01135
01136     txrx_packet();
01137 }

```

3.5.3.37 void dynamixel2::write_dword (unsigned char *id*, int *address*, unsigned long *value*)

```

01198 {
01199     unsigned short length = 4;
01200     gbInstructionPacket[PRT2_PKT_ID] = id;
01201     gbInstructionPacket[PRT2_PKT_LENGTH_L] =
    LOBYTE(length+5);
01202     gbInstructionPacket[PRT2_PKT_LENGTH_H] =
    HIBYTE(length+5);
01203     gbInstructionPacket[PRT2_PKT_INSTRUCTION] =
    INST_WRITE;
01204     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+0
    ] = LOBYTE(address);
01205     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+1
    ] = HIBYTE(address);
01206     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+2
    ] = LOBYTE(LOWORD( value ));
01207     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+3
    ] = HIBYTE(LOWORD( value ));
01208     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+4
    ] = LOBYTE(HIWORD( value ));
01209     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+5
    ] = HIBYTE(HIWORD( value ));
01210
01211     txrx_packet();
01212 }

```

3.5.3.38 void dynamixel2::write_word (unsigned char *id*, int *address*, unsigned short *value*)

```

01161 {
01162     unsigned short length = 2;
01163     gbInstructionPacket[PRT2_PKT_ID] = id;
01164     gbInstructionPacket[PRT2_PKT_LENGTH_L] =
    LOBYTE(length+5);
01165     gbInstructionPacket[PRT2_PKT_LENGTH_H] =
    HIBYTE(length+5);
01166     gbInstructionPacket[PRT2_PKT_INSTRUCTION] =
    INST_WRITE;
01167     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+0
    ] = LOBYTE(address);
01168     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+1
    ] = HIBYTE(address);
01169     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+2
    ] = LOBYTE( value );
01170     gbInstructionPacket[PRT2_INSTRUCTION_PKT_PARAMETER0+3
    ] = HIBYTE( value );
01171
01172     txrx_packet();
01173 }

```

3.5.4 Member Data Documentation

3.5.4.1 dxl_hal dynamixel2::dH [private]

3.5.4.2 int dynamixel2::gbCommStatus = COMM_RXSUCCESS [private]

3.5.4.3 unsigned char dynamixel2::gbInstructionPacket[MAXNUM_TXPACKET] = {0} [private]

3.5.4.4 unsigned int dynamixel2::gbRxGetLength = 0 [private]

3.5.4.5 unsigned int dynamixel2::gbRxPacketLength = 0 [private]

3.5.4.6 `unsigned char dynamixel2::gbStatusPacket[MAXNUM_RXPACKET] = {0}` [private]

3.5.4.7 `SyncBulkData dynamixel2::gBulkData[MAX_ID+1]` [private]

3.5.4.8 `double dynamixel2::gdByteTransTime = 0.0` [private]

3.5.4.9 `double dynamixel2::gdPacketStartTime = 0.0` [private]

3.5.4.10 `double dynamixel2::gdRcvWaitTime = 0.0` [private]

3.5.4.11 `int dynamixel2::giBusUsing = 0` [private]

3.5.4.12 `PingData dynamixel2::gPingData[MAX_ID+1]` [private]

3.5.4.13 `SyncBulkData dynamixel2::gSyncData[MAX_ID+1]` [private]

The documentation for this class was generated from the following files:

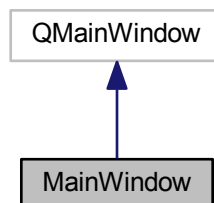
- [dxl/dynamixel.h](#)
- [dxl/dynamixel.cpp](#)

3.6 MainWindow Class Reference

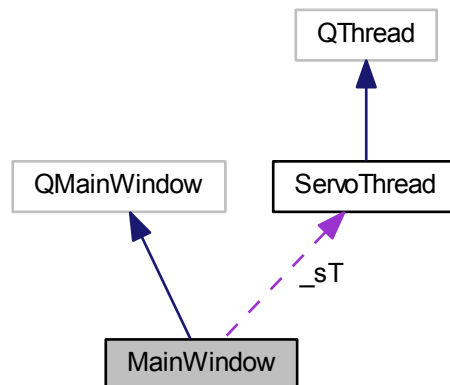
Contains all the windows and other classes.

```
#include <mainwindow.h>
```

Inheritance diagram for MainWindow:



Collaboration diagram for MainWindow:



Signals

- void [joystickChanged](#) ()
Emmitted when a joystick changes.

Public Member Functions

- [MainWindow](#) (QWidget *parent=0)
Default constructor.
- [~MainWindow](#) ()
Default destructor.

Private Slots

- void [joyChanged](#) ()
Handles a joystick update.
- void [on_actionOptions_triggered](#) ()
To select the options.
- void [update](#) ()
Updates all data to the servo thread.

Private Attributes

- QVector< QLabel * > [_axis](#)
Handles all the axis labels.
- QVector< float > [_axisV](#)
Contains the axis value;.
- QVector< QLabel * > [_buts](#)
Handles all the button labels.
- QVector< bool > [_butsV](#)

- Handles all buttons values.*
- `QString _dataP`
Contains the path to the data location.
- `int _jAxisX = -1`
Axis for the X value.
- `int _jAxisY = -1`
Axis for the Y value.
- `int _jAxisZ = -1`
Axis for the Z value.
- `XJoystick _joy`
To handle the joystick.
- `ServoThread _sT`
Contains the thread controlling all the servos and external hardware.
- `QTimer _timer`
To update the joystick value.
- `Ui::MainWindow * ui`
Contains the user interface.

Static Private Attributes

- `static const int sCount = 3`
Contains the number of minimum servos to work.
- `static const int aSCount = 0`
Contains the number of additional servos used.

3.6.1 Detailed Description

Contains all the windows and other classes.

3.6.2 Constructor & Destructor Documentation

3.6.2.1 MainWindow::MainWindow (QWidget * parent = 0) [explicit]

Default constructor.

```

00005                                     :
00006     QMainWindow(parent),
00007     _axis(XJoystick::AxisCount),
00008     _axisV(XJoystick::AxisCount),
00009     _buts(XJoystick::ButtonCount),
00010     _butsV(XJoystick::ButtonCount),
00011     ui(new Ui::MainWindow)
00012 {
00013     ui->setupUi(this);
00014     _sT.start();
00015     _timer.setInterval(10);
00016     _timer.start();
00017
00018     connect(&_amp;_joy, SIGNAL(changed()), this, SLOT(joyChanged()));
00019     connect(&_amp;_timer, SIGNAL(timeout()), this, SLOT(update()));
00020
00021     // JOYSTICK
00022     QVector< QString > V(_amp;_joy.getAllAxis());
00023     // Adding axis
00024     QGridLayout *wL = new QGridLayout;
00025     for (int i = 0; i < XJoystick::AxisCount; ++i) {
00026         QHBoxLayout *L = new QHBoxLayout;
00027         L->addWidget(new QLabel(V[i].append(":"), this));
00028         _axis[i] = new QLabel("#");
00029         L->addWidget(_axis[i]);
00030         L->addStretch();

```

```

00031         wL->addLayout(L, i%3, i/3);
00032     }
00033     ui->joyAxis->setLayout(wL);
00034
00035     // Adding buttons
00036     wL = new QGridLayout;
00037     for (int i = 0; i < XJoystick::ButtonCount; ++i) {
00038         _buts[i] = new QLabel(QString::number(i + 1));
00039         wL->addWidget(_buts[i], i/8, i%8);
00040         _buts[i]->setEnabled(false);
00041         _buts[i]->hide();
00042     }
00043     ui->joyButs->setLayout(wL);
00044     ui->joyAxis->hide();
00045     ui->joyButs->hide();
00046     ui->line->hide();
00047     // TODO: Create dataPath
00048
00049     _dataP = QStandardPaths::writableLocation(QStandardPaths::AppDataLocation);
00050     QDir dir(_dataP);
00051     if (!dir.exists()) dir.mkpath(_dataP);
00052 }

```

3.6.2.2 MainWindow::~MainWindow ()

Default destructor.

```

00055 {
00056     delete ui;
00057 }

```

3.6.3 Member Function Documentation

3.6.3.1 void MainWindow::joyChanged () [private],[slot]

Handles a joystick update.

```

00060 {
00061     int sel = _joy.current();
00062
00063     QVector< XJoystick::Info > V(_joy.available());
00064     bool found = false;
00065     int i = 0;
00066     while (i < V.size() and not found) { found = V[i].ID == sel; ++i; }
00067     if (not found) {
00068         if (V.size() > 0) {
00069             _joy.select(V[0].ID);
00070             ui->line->hide();
00071
00072             // Showing axis
00073             ui->joyAxis->show();
00074
00075             // Showing buttons
00076             for (QLabel *l : _buts) l->hide();
00077             ui->joyButs->show();
00078             int n = _joy.buttonCount();
00079             for (int i = 0; i < n; ++i) _buts[i]->show();
00080         }
00081         else {
00082             _joy.select(-1);
00083             ui->joyAxis->hide();
00084             ui->joyButs->hide();
00085             ui->line->hide();
00086         }
00087     }
00088     emit joystickChanged();
00089 }

```

3.6.3.2 void MainWindow::joystickChanged () [signal]

Emitted when a joystick changes.

3.6.3.3 void MainWindow::on_actionOptions_triggered () [private],[slot]

To select the options.

```
00093 {
00094     OptionsWindow o(_joy, &_sT, this);
00095     o.exec();
00096
00097     connect(this, SIGNAL(joystickChanged()), &o, SLOT(
00098         joystickChanged()));
00099
00099     if (o.result()) o.storeData();
00100 }
```

3.6.3.4 void MainWindow::update () [private],[slot]

Updates all data to the servo thread.

```
00103 {
00104     _joy.update();
00105     for (int i = 0; i < XJoystick::AxisCount; ++i) _axisV[i] = _joy[i];
00106     for (int i = 0; i < XJoystick::ButtonCount; ++i) _butsV[i] = _joy.button(i);
00107
00108     _sT.setData(_axisV, _butsV);
00109
00110     // TODO: Finish update function
00111 }
```

3.6.4 Member Data Documentation**3.6.4.1 QVector< QLabel *> MainWindow::_axis [private]**

Handles all the axis labels.

3.6.4.2 QVector< float > MainWindow::_axisV [private]

Contains the axis value;.

3.6.4.3 QVector< QLabel *> MainWindow::_buts [private]

Handles all the button labels.

3.6.4.4 QVector< bool > MainWindow::_butsV [private]

Handles all buttons values.

3.6.4.5 QString MainWindow::_dataP [private]

Contains the path to the data location.

3.6.4.6 int MainWindow::_jAxisX = -1 [private]

Axis for the X value.

3.6.4.7 int MainWindow::_jAxisY = -1 [private]

Axis for the Y value.

3.6.4.8 `int MainWindow::_jAxisZ = -1` `[private]`

AXis for the Z value.

3.6.4.9 `XJoystick MainWindow::_joy` `[private]`

To handle the joystick.

3.6.4.10 `ServoThread MainWindow::_sT` `[private]`

Contains the thread controlling all the servos and external hardware.

3.6.4.11 `QTimer MainWindow::_timer` `[private]`

To update the joystick value.

3.6.4.12 `const int MainWindow::aSCount = 0` `[static], [private]`

Contains the number of additional servos used.

3.6.4.13 `const int MainWindow::sCount = 3` `[static], [private]`

Contains the number of minimun servos to work.

3.6.4.14 `Ui::MainWindow* MainWindow::ui` `[private]`

Contains the user interface.

The documentation for this class was generated from the following files:

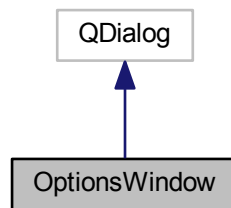
- [mainwindow.h](#)
- [mainwindow.cpp](#)

3.7 OptionsWindow Class Reference

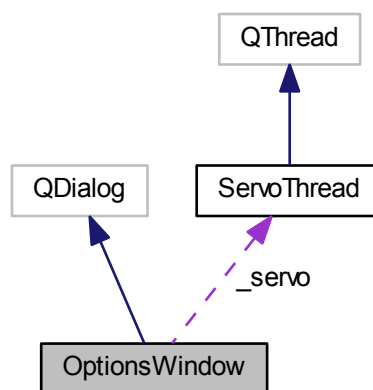
Class used to handle a Window to set the options.

```
#include <optionswindow.h>
```


Inheritance diagram for OptionsWindow:



Collaboration diagram for OptionsWindow:



Public Slots

- void `joystickChanged` ()
To handle the change of a joystick.

Public Member Functions

- `OptionsWindow` (XJoystick &J, `ServoThread` *servo, QWidget *parent=0)
Default constructor.
- `~OptionsWindow` ()
Destructor.
- void `storeData` ()
Stores all data.

Private Slots

- void `events()`
Handles events that need to be updated continously.
- void `on_servoRefresh_clicked()`
Refreshes all the servos connected to the port.

Private Attributes

- XJoystick & `_joy`
Contains the Joystick to handle options.
- int `_portSize`
Contains the size of the ports.
- ServoThread * `_servo`
Pointer to the servo thread class.
- QTimer `_timer`
Waits for a new COM port.
- Ui::OptionsWindow * `ui`
Containsh the GUI.

3.7.1 Detailed Description

Class used to handle a Window to set the options.

3.7.2 Constructor & Destructor Documentation

3.7.2.1 OptionsWindow::OptionsWindow (XJoystick & J, ServoThread * servo, QWidget * parent = 0) [explicit]

Default constructor.

```

00005                                     :
00006     QDialog(parent),
00007     _joy(J),
00008     _portSize(-1),
00009     _servo(servo),
00010     _timer(this),
00011     ui(new Ui::OptionsWindow)
00012 {
00013     ui->setupUi(this);
00014     this->setWindowTitle("Options");
00015
00016     QVector< QString > A(_joy.getAllAxis());
00017
00018     ui->joyMX->addItem("None", -1);
00019     ui->joyMY->addItem("None", -1);
00020     ui->joyMZ->addItem("None", -1);
00021
00022     for (int i = 0; i < A.size(); ++i) ui->joyMX->addItem(A[i], i);
00023     for (int i = 0; i < A.size(); ++i) ui->joyMY->addItem(A[i], i);
00024     for (int i = 0; i < A.size(); ++i) ui->joyMZ->addItem(A[i], i);
00025
00026     joystickChanged();
00027
00028     _timer.setInterval(500);
00029     _timer.setSingleShot(false);
00030     _timer.start();
00031     connect(&_timer, SIGNAL(timeout()), this, SLOT(events()));
00032
00033 }
```

3.7.2.2 OptionsWindow::~~OptionsWindow ()

Destructor.

```
00036 {
00037     delete ui;
00038 }
```

3.7.3 Member Function Documentation

3.7.3.1 void OptionsWindow::events () [private],[slot]

Handles events that need to be updated continuously.

```
00069 {
00070     auto ports = QSerialPortInfo::availablePorts();
00071
00072     if (ports.size() != _portSize) {
00073         _portSize = ports.size();
00074
00075         QString portC(ui->portC->currentData().toString());
00076         QString portS(ui->portS->currentData().toString());
00077
00078         int selC = 0, selS = 0;
00079
00080         ui->portC->clear();
00081         ui->portS->clear();
00082
00083         ui->portC->addItem("None", "");
00084         ui->portS->addItem("None", "");
00085
00086         for (int i = 0; i < ports.size(); ++i) {
00087             QString text(ports[i].portName());
00088             text += ": " + ports[i].description();
00089             ui->portC->addItem(text, ports[i].portName());
00090             ui->portS->addItem(text, ports[i].portName());
00091
00092             if (ports[i].portName() == portC) selC = i + 1;
00093             if (ports[i].portName() == portS) selS = i + 1;
00094         }
00095
00096         ui->portC->setCurrentIndex(selC);
00097         ui->portS->setCurrentIndex(selS);
00098     }
00099 }
```

3.7.3.2 void OptionsWindow::joystickChanged () [slot]

To handle the change of a joystick.

```
00049 {
00050     // Clear all the items and write the new items
00051     ui->joySel->clear();
00052     ui->joySel->addItem("None", -1);
00053
00054     // Adding items and searching the current
00055     int pos = 0;
00056     QVector<XJoystick::Info> V(_joy.available());
00057     for (int i = 0; i < V.size(); ++i) {
00058         QString text(V[i].name);
00059         text += ": " + QString::number(V[i].ID);
00060         if (V[i].ID == _joy.current()) pos = i;
00061         ui->joySel->addItem(text, V[i].ID);
00062     }
00063     ui->joySel->setCurrentIndex(pos);
00064
00065     ui->joyN->setText(QString::number(V.size()));
00066 }
```

3.7.3.3 void OptionsWindow::on_servoRefresh_clicked () [private],[slot]

Refreshes all the servos connected to the port.

```

00102 {
00103     dynamixel dxl;
00104     QString port;
00105     int baud;
00106     _servo->getServoPortInfo(port, baud);
00107
00108     dxl.initialize(port, baud);
00109
00110 }

```

3.7.3.4 void OptionsWindow::storeData ()

Stores all data.

```

00041 {
00042     // Storing joystick data
00043     _joy.select(ui->joySel->currentData().toInt());
00044
00045
00046 }

```

3.7.4 Member Data Documentation

3.7.4.1 XJoystick& OptionsWindow::_joy [private]

Contains the Joystick to handle options.

3.7.4.2 int OptionsWindow::_portSize [private]

Contains the size of the ports.

3.7.4.3 ServoThread* OptionsWindow::_servo [private]

Pointer to the servo thread class.

3.7.4.4 QTimer OptionsWindow::_timer [private]

Waits for a new COM port.

3.7.4.5 Ui::OptionsWindow* OptionsWindow::_ui [private]

Containsh the GUI.

The documentation for this class was generated from the following files:

- [optionswindow.h](#)
- [optionswindow.cpp](#)

3.8 dynamixel2::ping_data Struct Reference

Struct used to do a ping.

Public Attributes

- int [iID](#)
- int [iModelNo](#)
- int [iFirmVer](#)

3.8.1 Detailed Description

Struct used to do a ping.

3.8.2 Member Data Documentation

3.8.2.1 int dynamixel2::ping_data::iFirmVer

3.8.2.2 int dynamixel2::ping_data::iID

3.8.2.3 int dynamixel2::ping_data::iModelNo

The documentation for this struct was generated from the following file:

- [dxl/dynamixel.h](#)

3.9 ServoThread::Servo Struct Reference

Struct for the [AX12](#) servos.

```
#include <servothread.h>
```

Public Member Functions

- [Servo](#) (int [ID](#)=-1, double [load](#)=-1, double [pos](#)=-1)
Default constructor.
- [Servo](#) (const [Servo](#) &s)
Copy constructor.

Public Attributes

- int [ID](#)
Contains the servo ID.
- double [load](#)
Contains the servo load.
- double [pos](#)
Contains the servo position.

3.9.1 Detailed Description

Struct for the [AX12](#) servos.

3.9.2 Constructor & Destructor Documentation

3.9.2.1 ServoThread::Servo::Servo (int *ID* = -1, double *load* = -1, double *pos* = -1) [inline]

Default constructor.

```
00042         : ID(ID), load(load), pos(pos) {}
```

3.9.2.2 ServoThread::Servo::Servo (const Servo & s) [inline]

Copy constructor.

```
00045 : ID(s.ID), load(s.load), pos(s.pos) {}
```

3.9.3 Member Data Documentation

3.9.3.1 int ServoThread::Servo::ID

Contains the servo ID.

3.9.3.2 double ServoThread::Servo::load

Contains the servo load.

3.9.3.3 double ServoThread::Servo::pos

Contains the servo position.

The documentation for this struct was generated from the following file:

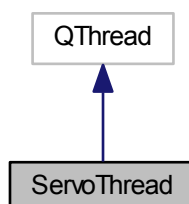
- [servothread.h](#)

3.10 ServoThread Class Reference

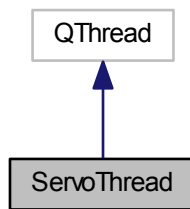
The [ServoThread](#)'s class handles the communication between the delta robot servos and the PC.

```
#include <servothread.h>
```

Inheritance diagram for ServoThread:



Collaboration diagram for ServoThread:



Classes

- struct [Servo](#)
Struct for the [AX12](#) servos.

Public Types

- enum [Mode](#) { [controlled](#), [manual](#) }
Contains the working mode.

Public Member Functions

- [ServoThread](#) ()
Default constructor.
- [~ServoThread](#) ()
Default destructor.
- void [cont](#) ()
Continues program's execution.
- void [end](#) ()
Ends the execution.
- void [load](#) (QString &file)
Loads the data from the selected file.
- void [pause](#) ()
Pauses the execution.
- int [getServoBaud](#) ()
Returns the current servo Baud rate.
- QString [getServoPort](#) ()
Returns the current servo Port.
- void [getServoPortInfo](#) (QString &port, int &baud)
Returns both servo Port and baud Rate.
- void [getServosInfo](#) (QVector< [Servo](#) > &V)
Returns the servos info, with all its load and current position.
- QVector< [Servo](#) > [getServosInfo](#) ()
Overloaded function to get the servo info.
- void [setData](#) (QVector< float > &aV, QVector< bool > &butS)

- *Adds the loaded data.*
- void `setServoBaud` (unsigned int baud)
Sets the servos port baud rate.
- void `setServoPort` (QString &port)
Sets the servos port.
- void `setServoPortInfo` (QString &port, unsigned int baud)
Sets the servos port info, data and selected port.
- void `setSID` (QVector< int > &V)
Sets the servos ID.
- void `write` (QString &file)
Writes data to the selected directory.

Private Types

- enum `Version` { `v_1_0` }
Enum containing all the save file versions.

Private Member Functions

- void `run` ()
Used to create another thread.
- void `setAngles` (double x0, double y0, double z0, double &theta1, double &theta2, double &theta3)
Used to calculate the servos angles.
- double `singleAngle` (double x0, double y0, double z0)
Calculates the angle of one servo in the selected position.

Private Attributes

- double `cos60` = 0.5
Contains the cosinus of 60.
- double `sin60` = sqrt(3)/2
Contains the sinus of 60.
- const double `a`
The arm length.
- const double `b`
The forearm length.
- const double `L1`
The base center lenght.
- const double `L2`
The platform center length.
- QVector< float > `_axis`
Contains the axis value.
- QVector< bool > `_buts`
Contains the buttons value.
- int `_cBaud`
Contains the baud rate used to communicate with the clamp.
- QWaitCondition `_cond`
To start and pause the thread.
- QString `_cPort`
Contains the selected com port used to comunitate with the clamp.

- bool [_dChanged](#)
True if the data changes.
- bool [_end](#)
True when we must end executino.
- Mode [_mod](#)
Contains the working mode.
- QMutex [_mutex](#)
To prevent memory errors.
- bool [_pause](#)
Pauses the execution of the thread.
- int [_sBaud](#)
Contains the used baud rate to communicate with the servos.
- QVector< [Servo](#) > [_servos](#)
Contains the servos information.
- QString [_sPort](#)
Contains the selected com port used in the communication with servos.
- bool [_sPortChanged](#)
True if the servos port changes.

3.10.1 Detailed Description

The [ServoThread](#)'s class handles the communication between the delta robot servos and the PC.

3.10.2 Member Enumeration Documentation

3.10.2.1 enum [ServoThread::Mode](#)

Contains the working mode.

Enumerator

controlled
manual

```
00050      {
00051          controlled,
00052          manual
00053      };
```

3.10.2.2 enum [ServoThread::Version](#) `[private]`

Enum containing all the save file versions.

Enumerator

v_1_0

```
00027      {
00028          v\_1\_0
00029      };
```

3.10.3 Constructor & Destructor Documentation

3.10.3.1 ServoThread::ServoThread ()

Default constructor.

```

00004         :
00005         _axis(XJoystick::AxisCount),
00006         _buts(XJoystick::ButtonCount),
00007         _cBaud(9600),
00008         _cPort("COM3"),
00009         _dChanged(false),
00010         _end(false),
00011         _mod(Mode::manual),
00012         _pause(true),
00013         _sBaud(1000000),
00014         _servos(3),
00015         _sPort("COM9"),
00016         _sPortChanged(false)
00017 {
00018
00019 }
```

3.10.3.2 ServoThread::~ServoThread ()

Default destructor.

```

00022 {
00023     _mutex.lock();
00024     _end = true;
00025     _cond.wakeOne();
00026     _mutex.unlock();
00027
00028     wait();
00029 }
```

3.10.4 Member Function Documentation

3.10.4.1 void ServoThread::cont () [inline]

Continues program's execution.

```

00063     {
00064         _mutex.lock();
00065         _pause = false;
00066         _cond.wakeOne();
00067         _mutex.unlock();
00068     }
```

3.10.4.2 void ServoThread::end () [inline]

Ends the execution.

```

00072     {
00073         _mutex.lock();
00074         _end = true;
00075         _cond.wakeOne();
00076         _mutex.unlock();
00077
00078         wait();
00079     }
```

3.10.4.3 `int ServoThread::getServoBaud () [inline]`

Returns the current servo Baud rate.

```
00094     {
00095         QMutexLocker mL(&_mutex);
00096         return _sBaud;
00097     }
```

3.10.4.4 `QString ServoThread::getServoPort () [inline]`

Returns the current servo Port.

```
00101     {
00102         QMutexLocker mL(&_mutex);
00103         return _sPort;
00104     }
```

3.10.4.5 `void ServoThread::getServoPortInfo (QString & port, int & baud) [inline]`

Returns both servo Port and baud Rate.

```
00108     {
00109         _mutex.lock();
00110         baud = _sBaud;
00111         port = _sPort;
00112         _mutex.unlock();
00113     }
```

3.10.4.6 `void ServoThread::getServosInfo (QVector< Servo > & V) [inline]`

Returns the servos info, with all its load and current position.

Parameters

V	Servo vector to store information
---	-----------------------------------

```
00119     {
00120         _mutex.lock();
00121         V = _servos;
00122         _mutex.unlock();
00123     }
```

3.10.4.7 `QVector<Servo> ServoThread::getServosInfo () [inline]`

Overloaded function to get the servo info.

```
00127     {
00128         QMutexLocker mL(&_mutex);
00129         return _servos;
00130     }
```

3.10.4.8 `void ServoThread::load (QString & file)`

Loads the data from the selected file.

```

00032 {
00033     _mutex.lock();
00034     QFile f(file);
00035     f.open(QIODevice::ReadOnly);
00036     QDataStream df(&f);
00037
00038     int ver;
00039     df >> ver;
00040     if (ver == Version::v_1_0) {
00041         int n;
00042         df >> _cBaud >> _cPort >> _sBaud >> _sPort >> n;
00043
00044         _servos.resize(n);
00045         for (Servo &s : _servos) df >> s.ID;
00046         _dChanged = true;
00047     }
00048     else qWarning() << "Not a valid file";
00049     _mutex.unlock();
00050 }

```

3.10.4.9 void ServoThread::pause () [inline]

Pauses the execution.

```

00086 {
00087     _mutex.lock();
00088     _pause = true;
00089     _mutex.unlock();
00090 }

```

3.10.4.10 void ServoThread::run () [private]

Used to create another thread.

```

00078 {
00079     _mutex.lock();
00080     int sBaud = _sBaud;
00081     QString sPort = _sPort;
00082
00083     _mutex.unlock();
00084     dynamixel dxl(sPort, sBaud);
00085     QVector< AX12 > (_servos.size(), &dxl);
00086
00087     while (not _end) {
00088
00089         msleep(10);
00090         _mutex.lock();
00091         if (not _end and _pause) {
00092             dxl.terminate();
00093             _cond.wait(&_mutex);
00094             dxl.initialize(sPort, sBaud);
00095         }
00096         if (_dChanged) {
00097             if (sPort != _sPort) {
00098                 sPort = _sPort;
00099                 sBaud = _sBaud;
00100                 dxl.terminate();
00101                 dxl.initialize(sPort, sBaud);
00102             }
00103         }
00104         _dChanged = false;
00105         _mutex.unlock();
00106     }
00107
00108     dxl.terminate();
00109     exit(0);
00110 }

```

3.10.4.11 void ServoThread::setAngles (double x0, double y0, double z0, double &theta1, double &theta2, double &theta3) [private]

Used to calculate the servos angles.

```

00114 {
00115     double x1 = x0 + L2 - L1;
00116     double y1 = y0;
00117     double z1 = z0;
00118     theta1 = singleAngle(x1,y1,z1);
00119
00120     double x2 = z0*sin60 - x0*cos60 + L2 - L1;
00121     double y2 = y0;
00122     double z2 = -z0*cos60 - x0*sin60;
00123     theta2 = singleAngle(x2,y2,z2);
00124
00125     double x3 = -z0*sin60 - x0*cos60 + L2 - L1;
00126     double y3 = y0;
00127     double z3 = -z0*cos60 + x0*sin60;
00128     theta3 = singleAngle(x3,y3,z3);
00129 }

```

3.10.4.12 void ServoThread::setData (QVector< float > & aV, QVector< bool > & buts)

Adds the loaded data.

Parameters

<i>aV</i>	Contains the axis values
<i>buts</i>	Contains the buttons values

```

00053 {
00054     _mutex.lock();
00055     // Copying the joystick values
00056     _axis = aV;
00057     _buts = buts;
00058     _dChanged = true;
00059
00060     _mutex.unlock();
00061 }

```

3.10.4.13 void ServoThread::setServoBaud (unsigned int baud) [inline]

Sets the servos port baud rate.

Parameters

<i>baud</i>	Positive number containing the baud rate
-------------	--

```

00140 {
00141     _mutex.lock();
00142     _sBaud = baud;
00143     _mutex.unlock();
00144 }

```

3.10.4.14 void ServoThread::setServoPort (QString & port) [inline]

Sets the servos port.

Parameters

<i>port</i>	String containing the port name
-------------	---------------------------------

```

00149 {
00150     _mutex.lock();
00151     _sPort = port;
00152     _mutex.unlock();
00153 }

```

3.10.4.15 void ServoThread::setServoPortInfo (QString & port, unsigned int baud) [inline]

Sets the servos port info, data and selected port.

Parameters

<i>port</i>	String containing the selected port
<i>baud</i>	Contains the selected baud rate

```

00159     {
00160         _mutex.lock();
00161         _sPort = port;
00162         _sBaud = baud;
00163         _mutex.unlock();
00164     }

```

3.10.4.16 void ServoThread::setSID (QVector< int > & V) [inline]

Sets the servos ID.

Parameters

<i>V</i>	Vector containing all the servos ID
----------	-------------------------------------

```

00169     {
00170         _mutex.lock();
00171         if (V.size() != _servos.size()) _servos.resize(V.size());
00172         for (int i = 0; i < V.size(); ++i) _servos[i].ID = V[i];
00173         _dChanged = true;
00174         _mutex.unlock();
00175     }
00176 }

```

3.10.4.17 double ServoThread::singleAngle (double x0, double y0, double z0) [private]

Calculates the angle of one servo in the selected position.

```

00132 {
00133     double n = b * b - a * a - z0 * z0 - x0 * x0 - y0 * y0;
00134     double raiz = sqrt (n*n*y0*y0 - 4*(x0*x0 + y0*y0)*(-x0*x0*a*a + n*n/4));
00135     if (x0 < 0) raiz *= -1;
00136     double y = (-n*y0 + raiz ) / (2*(x0*x0 + y0*y0));
00137     int signe = 1;
00138     if ((b*b - (y0 + a)*(y0 + a)) < (x0*x0 + z0*z0) && x0 < 0) signe *= -1;
00139     double x = sqrt(a*a - y*y)*signe;
00140     return atan2 (y,x);
00141 }
00142 }
00143 }

```

3.10.4.18 void ServoThread::write (QString & file)

Writes data to the selected directory.

Parameters

<i>file</i>	Path to the file
-------------	------------------

```

00064 {
00065     _mutex.lock();
00066     QFile f(file);
00067     f.open(QIODevice::WriteOnly);
00068     QDataStream df(&f);
00069     df << int (Version::v_1_0) << _cBaud << _cPort << _sBaud <<
00070     _sPort
00071     << _servos.size();
00072     for (const Servo &s : _servos) df << s.ID;
00073     _mutex.unlock();
00074 }
00075 }

```

3.10.5 Member Data Documentation

3.10.5.1 `QVector< float > ServoThread::_axis` [private]

Contains the axis value.

3.10.5.2 `QVector< bool > ServoThread::_buts` [private]

Contains the buttons value.

3.10.5.3 `int ServoThread::_cBaud` [private]

Contains the baud rate used to communicate with the clamp.

3.10.5.4 `QWaitCondition ServoThread::_cond` [private]

To start and pause the thread.

3.10.5.5 `QString ServoThread::_cPort` [private]

Contains the selected com port used to communicate with the clamp.

3.10.5.6 `bool ServoThread::_dChanged` [private]

True if the data changes.

3.10.5.7 `bool ServoThread::_end` [private]

True when we must end execution.

3.10.5.8 `Mode ServoThread::_mod` [private]

Contains the working mode.

3.10.5.9 `QMutex ServoThread::_mutex` [private]

To prevent memory errors.

3.10.5.10 `bool ServoThread::_pause` [private]

Pauses the execution of the thread.

3.10.5.11 `int ServoThread::_sBaud` [private]

Contains the used baud rate to communicate with the servos.

3.10.5.12 `QVector< Servo > ServoThread::_servos` [private]

Contains the servos information.

3.10.5.13 `QString ServoThread::_sPort` [private]

Contains the selected com port used in the communication with servos.

3.10.5.14 `bool ServoThread::_sPortChanged` [private]

True if the servos port changes.

3.10.5.15 `const double ServoThread::a` [private]

The arm length.

3.10.5.16 `const double ServoThread::b` [private]

The forearm length.

3.10.5.17 `double ServoThread::cos60 = 0.5` [private]

Contains the cosinus of 60.

3.10.5.18 `const double ServoThread::L1` [private]

The base center lenght.

3.10.5.19 `const double ServoThread::L2` [private]

The platform center length.

3.10.5.20 `double ServoThread::sin60 = sqrt(3)/2` [private]

Contains the sinus of 60.

The documentation for this class was generated from the following files:

- [servothread.h](#)
- [servothread.cpp](#)

Chapter 4

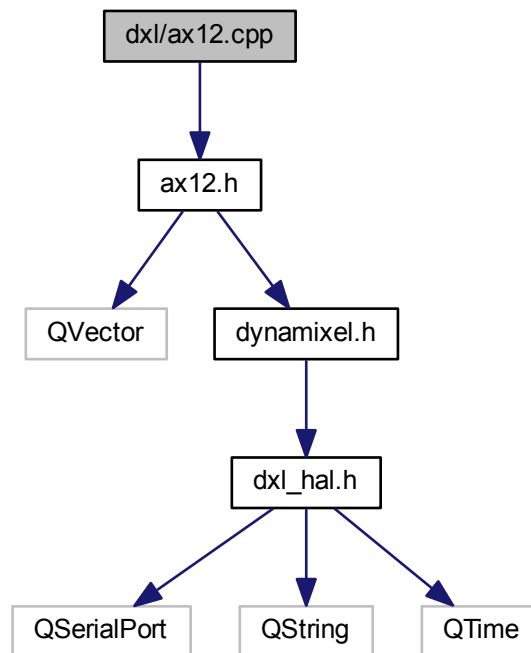
File Documentation

4.1 dxl/ax12.cpp File Reference

Contains the [AX12](#) class implementation.

```
#include "ax12.h"
```

Include dependency graph for ax12.cpp:



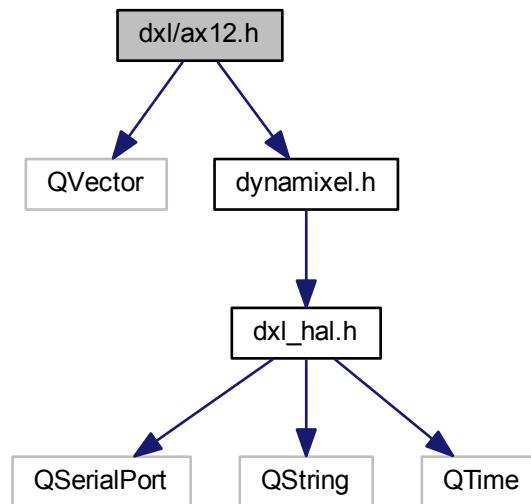
4.1.1 Detailed Description

Contains the [AX12](#) class implementation.

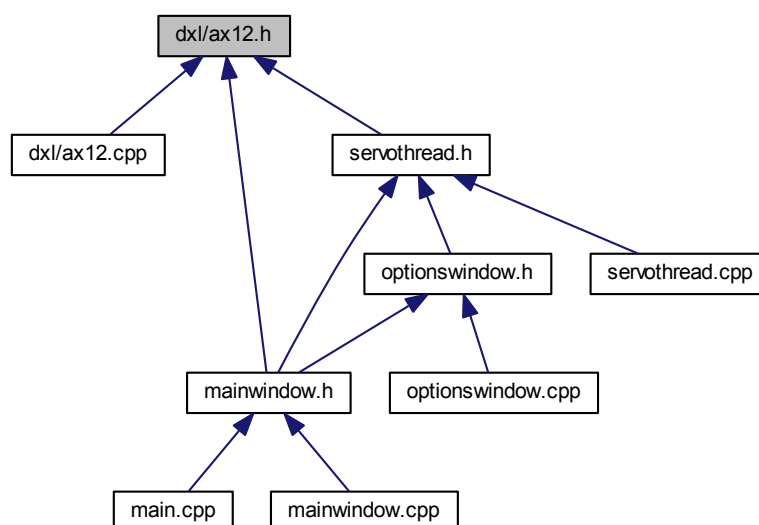
4.2 dxl/ax12.h File Reference

Contains the [AX12](#) class declaration.

```
#include <QVector>
#include "dynamixel.h"
Include dependency graph for ax12.h:
```



This graph shows which files directly or indirectly include this file:



Classes

- class [AX12](#)

The [AX12](#) class is used to control AX-12 motors from Dynamixel.

Macros

- `#define M_PI 3.14159265358979323846`

4.2.1 Detailed Description

Contains the [AX12](#) class declaration.

4.2.2 Macro Definition Documentation

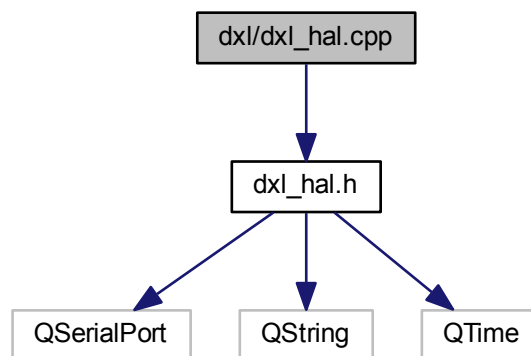
4.2.2.1 `#define M_PI 3.14159265358979323846`

4.3 dxl/dxl_hal.cpp File Reference

Contains the Dynamixel SDK platform dependent header source.

```
#include "dxl_hal.h"
```

Include dependency graph for dxl_hal.cpp:



4.3.1 Detailed Description

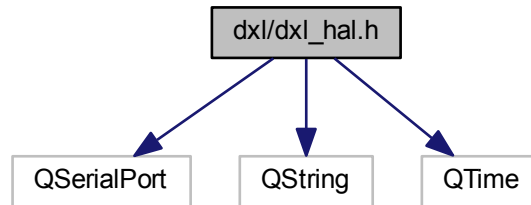
Contains the Dynamixel SDK platform dependent header source.

4.4 dxl/dxl_hal.h File Reference

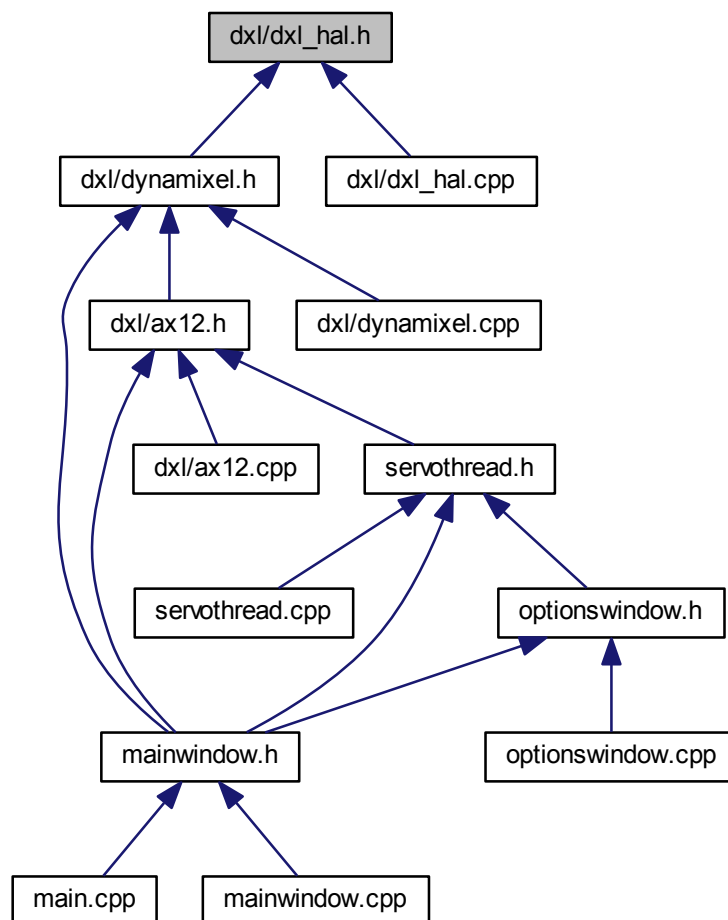
Contains the Dynamixel SDK platform dependent header declaration.

```
#include <QSerialPort>
#include <QString>
#include <QTime>
```

Include dependency graph for dxl_hal.h:



This graph shows which files directly or indirectly include this file:



Classes

- class [dxl_hal](#)
Dynamixel SDK platform dependent.

Macros

- `#define` [MAXNUM_TXPACKET](#) (10000)
- `#define` [MAXNUM_RXPACKET](#) (10000)

4.4.1 Detailed Description

Contains the Dynamixel SDK platform dependent header declaration.

4.4.2 Macro Definition Documentation

4.4.2.1 `#define` [MAXNUM_RXPACKET](#) (10000)

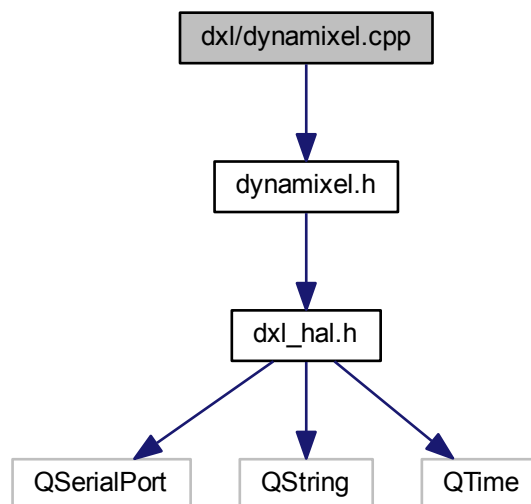
4.4.2.2 `#define` [MAXNUM_TXPACKET](#) (10000)

4.5 dxl/dynamixel.cpp File Reference

Contains the dynamixel and [dynamixel2](#) classes implementation.

```
#include "dynamixel.h"
```

Include dependency graph for dynamixel.cpp:



Macros

- `#define` [LATENCY_TIME](#) (16)

- `#define PING_STATUS_LENGTH (14)`

Functions

- unsigned short `update_crc` (unsigned short `crc_accum`, unsigned char `*data_blk_ptr`, unsigned short `data_blk_size`)

4.5.1 Detailed Description

Contains the `dynamixel` and `dynamixel2` classes implementation.

4.5.2 Macro Definition Documentation

4.5.2.1 `#define LATENCY_TIME (16)`

4.5.2.2 `#define PING_STATUS_LENGTH (14)`

4.5.3 Function Documentation

4.5.3.1 unsigned short `update_crc` (unsigned short `crc_accum`, unsigned char * `data_blk_ptr`, unsigned short `data_blk_size`)

```

00473 {
00474     unsigned short i, j;
00475     unsigned short crc_table[256] = {0x0000,
00476                                     0x8005, 0x800F, 0x000A, 0x801B, 0x001E, 0x0014, 0x8011,
00477                                     0x8033, 0x0036, 0x003C, 0x8039, 0x0028, 0x802D, 0x8027,
00478                                     0x0022, 0x8063, 0x0066, 0x006C, 0x8069, 0x0078, 0x807D,
00479                                     0x8077, 0x0072, 0x0050, 0x8055, 0x805F, 0x005A, 0x804B,
00480                                     0x004E, 0x0044, 0x8041, 0x80C3, 0x00C6, 0x00CC, 0x80C9,
00481                                     0x00D8, 0x80DD, 0x80D7, 0x00D2, 0x00F0, 0x80F5, 0x80FF,
00482                                     0x00FA, 0x80EB, 0x00EE, 0x00E4, 0x80E1, 0x00A0, 0x80A5,
00483                                     0x80AF, 0x00AA, 0x80BB, 0x00BE, 0x00B4, 0x80B1, 0x8093,
00484                                     0x0096, 0x009C, 0x8099, 0x0088, 0x808D, 0x8087, 0x0082,
00485                                     0x8183, 0x0186, 0x018C, 0x8189, 0x0198, 0x819D, 0x8197,
00486                                     0x0192, 0x01B0, 0x81B5, 0x81BF, 0x01BA, 0x81AB, 0x01AE,
00487                                     0x01A4, 0x81A1, 0x01E0, 0x81E5, 0x81EF, 0x01EA, 0x81FB,
00488                                     0x01FE, 0x01F4, 0x81F1, 0x81D3, 0x01D6, 0x01DC, 0x81D9,
00489                                     0x01C8, 0x81CD, 0x81C7, 0x01C2, 0x0140, 0x8145, 0x814F,
00490                                     0x014A, 0x815B, 0x015E, 0x0154, 0x8151, 0x8173, 0x0176,
00491                                     0x017C, 0x8179, 0x0168, 0x816D, 0x8167, 0x0162, 0x8123,
00492                                     0x0126, 0x012C, 0x8129, 0x0138, 0x813D, 0x8137, 0x0132,
00493                                     0x0110, 0x8115, 0x811F, 0x011A, 0x810B, 0x010E, 0x0104,
00494                                     0x8101, 0x8303, 0x0306, 0x030C, 0x8309, 0x0318, 0x831D,
00495                                     0x8317, 0x0312, 0x0330, 0x8335, 0x833F, 0x033A, 0x832B,
00496                                     0x032E, 0x0324, 0x8321, 0x0360, 0x8365, 0x836F, 0x036A,
00497                                     0x837B, 0x037E, 0x0374, 0x8371, 0x8353, 0x0356, 0x035C,
00498                                     0x8359, 0x0348, 0x834D, 0x8347, 0x0342, 0x03C0, 0x83C5,
00499                                     0x83CF, 0x03CA, 0x83DB, 0x03DE, 0x03D4, 0x83D1, 0x83F3,
00500                                     0x03F6, 0x03FC, 0x83F9, 0x03E8, 0x83ED, 0x83E7, 0x03E2,
00501                                     0x83A3, 0x03A6, 0x03AC, 0x83A9, 0x03B8, 0x83BD, 0x83B7,
00502                                     0x03B2, 0x0390, 0x8395, 0x839F, 0x039A, 0x838B, 0x038E,
00503                                     0x0384, 0x8381, 0x0280, 0x8285, 0x828F, 0x028A, 0x829B,
00504                                     0x029E, 0x0294, 0x8291, 0x82B3, 0x02B6, 0x02BC, 0x82B9,
00505                                     0x02A8, 0x82AD, 0x82A7, 0x02A2, 0x82E3, 0x02E6, 0x02EC,
00506                                     0x82E9, 0x02F8, 0x82FD, 0x82F7, 0x02F2, 0x02D0, 0x82D5,
00507                                     0x82DF, 0x02DA, 0x82CB, 0x02CE, 0x02C4, 0x82C1, 0x8243,
00508                                     0x0246, 0x024C, 0x8249, 0x0258, 0x825D, 0x8257, 0x0252,
00509                                     0x0270, 0x8275, 0x827F, 0x027A, 0x826B, 0x026E, 0x0264,
00510                                     0x8261, 0x0220, 0x8225, 0x822F, 0x022A, 0x823B, 0x0236,
00511                                     0x0234, 0x8231, 0x8213, 0x0216, 0x021C, 0x8219, 0x0208,
00512                                     0x820D, 0x8207, 0x0202 };
00513
00514     for(j = 0; j < data_blk_size; j++)
00515     {
00516         i = ((unsigned short)(crc_accum >> 8) ^ *data_blk_ptr++) & 0xFF;
00517         crc_accum = (crc_accum << 8) ^ crc_table[i];
00518     }
00519     return crc_accum;
00520 }
00521

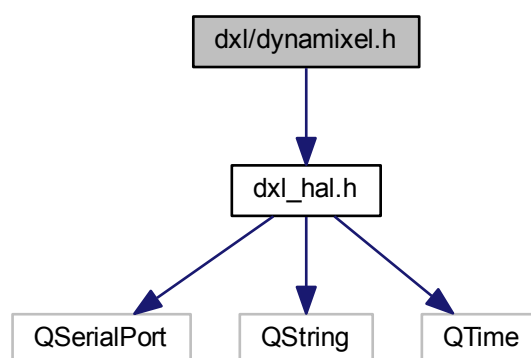
```

4.6 dxl/dynamixel.h File Reference

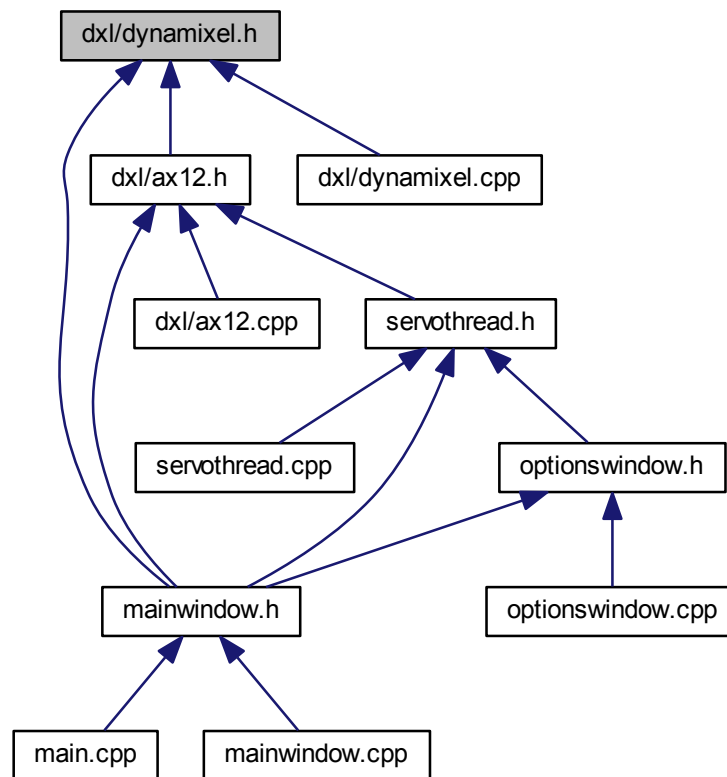
Contains the dynamixel and [dynamixel2](#) classes declaration.

```
#include "dxl_hal.h"
```

Include dependency graph for dynamixel.h:



This graph shows which files directly or indirectly include this file:



Classes

- class [dynamixel](#)
Dynamixel 1.0 protocol class.
- class [dynamixel2](#)
Dynamixel 2.0 protocol class.
- struct [dynamixel2::ping_data](#)
Struct used to do a ping.
- struct [dynamixel2::data](#)
Struct used to handle dynamixel data.

Macros

- #define [MAX_ID](#) (252)
- #define [BROADCAST_ID](#) (254)
- #define [COMM_TXSUCCESS](#) (0)
- #define [COMM_RXSUCCESS](#) (1)
- #define [COMM_TXFAIL](#) (2)
- #define [COMM_RXFAIL](#) (3)
- #define [COMM_TXERROR](#) (4)

- #define [COMM_RXWAITING](#) (5)
- #define [COMM_RXTIMEOUT](#) (6)
- #define [COMM_RXCORRUPT](#) (7)
- #define [ERRBIT_ALERT](#) (128)
- #define [ERR_RESULT_FAIL](#) (1)
- #define [ERR_INSTRUCTION](#) (2)
- #define [ERR_CRC](#) (3)
- #define [ERR_DATA_RANGE](#) (4)
- #define [ERR_DATA_LENGTH](#) (5)
- #define [ERR_DATA_LIMIT](#) (6)
- #define [ERR_ACCESS](#) (7)
- #define [PRT1_PKT_ID](#) (2)
- #define [PRT1_PKT_LENGTH](#) (3)
- #define [PRT1_PKT_INSTRUCTION](#) (4)
- #define [PRT1_PKT_ERRBIT](#) (4)
- #define [PRT1_PKT_PARAMETER0](#) (5)
- #define [PRT2_PKT_HEADER0](#) (0)
- #define [PRT2_PKT_HEADER1](#) (1)
- #define [PRT2_PKT_HEADER2](#) (2)
- #define [PRT2_PKT_RESERVED](#) (3)
- #define [PRT2_PKT_ID](#) (4)
- #define [PRT2_PKT_LENGTH_L](#) (5)
- #define [PRT2_PKT_LENGTH_H](#) (6)
- #define [PRT2_PKT_INSTRUCTION](#) (7)
- #define [PRT2_INSTRUCTION_PKT_PARAMETER0](#) (8)
- #define [PRT2_PKT_ERRBIT](#) (8)
- #define [PRT2_STATUS_PKT_PARAMETER0](#) (9)
- #define [INST_PING](#) (1)
- #define [INST_READ](#) (2)
- #define [INST_WRITE](#) (3)
- #define [INST_REG_WRITE](#) (4)
- #define [INST_ACTION](#) (5)
- #define [INST_RESET](#) (6)
- #define [INST_SYNC_WRITE](#) (131)
- #define [INST_BULK_READ](#) (146)
- #define [INST_REBOOT](#) (8)
- #define [INST_STATUS](#) (85)
- #define [INST_SYNC_READ](#) (130)
- #define [INST_BULK_WRITE](#) (147)
- #define [PING_INFO_MODEL_NUM](#) (1)
- #define [PING_INFO_FIRM_VER](#) (2)
- #define [MAKEWORD](#)(a, b) (((unsigned short)((((unsigned char)((((unsigned long)(a) & 0xff)) | ((unsigned short)((unsigned char)((((unsigned long)(b) & 0xff))) << 8))
- #define [MAKEDWORD](#)(a, b) (((unsigned int)((((unsigned short)((((unsigned long)(a) & 0xffff)) | ((unsigned int)((unsigned short)((((unsigned long)(b) & 0xffff))) << 16))
- #define [LOWORD](#)(l) (((unsigned short)((((unsigned long)(l) & 0xffff))
- #define [HIWORD](#)(l) (((unsigned short)((((unsigned long)(l) >> 16) & 0xffff))
- #define [LOBYTE](#)(w) (((unsigned char)((((unsigned long)(w) & 0xff))
- #define [HIBYTE](#)(w) (((unsigned char)((((unsigned long)(w) >> 8) & 0xff))

4.6.1 Detailed Description

Contains the dynamixel and [dynamixel2](#) classes declaration.

4.6.2 Macro Definition Documentation

4.6.2.1 `#define BROADCAST_ID (254)`

4.6.2.2 `#define COMM_RXCORRUPT (7)`

4.6.2.3 `#define COMM_RXFAIL (3)`

4.6.2.4 `#define COMM_RXSUCCESS (1)`

4.6.2.5 `#define COMM_RXTIMEOUT (6)`

4.6.2.6 `#define COMM_RXWAITING (5)`

4.6.2.7 `#define COMM_TXERROR (4)`

4.6.2.8 `#define COMM_TXFAIL (2)`

4.6.2.9 `#define COMM_TXSUCCESS (0)`

4.6.2.10 `#define ERR_ACCESS (7)`

4.6.2.11 `#define ERR_CRC (3)`

4.6.2.12 `#define ERR_DATA_LENGTH (5)`

4.6.2.13 `#define ERR_DATA_LIMIT (6)`

4.6.2.14 `#define ERR_DATA_RANGE (4)`

4.6.2.15 `#define ERR_INSTRUCTION (2)`

4.6.2.16 `#define ERR_RESULT_FAIL (1)`

4.6.2.17 `#define ERRBIT_ALERT (128)`

4.6.2.18 `#define HIBYTE(w) (((unsigned char)((((unsigned long)(w)) >> 8) & 0xff))`

4.6.2.19 `#define HIWORD(l) (((unsigned short)((((unsigned long)(l)) >> 16) & 0xffff))`

4.6.2.20 `#define INST_ACTION (5)`

4.6.2.21 `#define INST_BULK_READ (146)`

4.6.2.22 `#define INST_BULK_WRITE (147)`

4.6.2.23 `#define INST_PING (1)`

4.6.2.24 `#define INST_READ (2)`

4.6.2.25 `#define INST_REBOOT (8)`

4.6.2.26 `#define INST_REG_WRITE (4)`

4.6.2.27 `#define INST_RESET (6)`

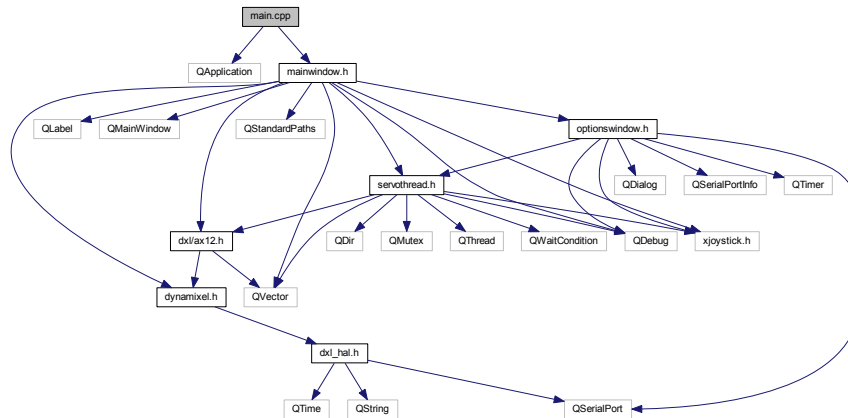
- 4.6.2.28 `#define INST_STATUS (85)`
- 4.6.2.29 `#define INST_SYNC_READ (130)`
- 4.6.2.30 `#define INST_SYNC_WRITE (131)`
- 4.6.2.31 `#define INST_WRITE (3)`
- 4.6.2.32 `#define LOBYTE(w) ((unsigned char)(((unsigned long)(w)) & 0xff))`
- 4.6.2.33 `#define LOWORD(l) ((unsigned short)(((unsigned long)(l)) & 0xffff))`
- 4.6.2.34 `#define MAKEDWORD(a, b) ((unsigned int)(((unsigned short)(((unsigned long)(a)) & 0xffff)) | ((unsigned int)((unsigned short)(((unsigned long)(b)) & 0xffff))) << 16))`
- 4.6.2.35 `#define MAKEWORD(a, b) ((unsigned short)(((unsigned char)(((unsigned long)(a)) & 0xff)) | ((unsigned short)((unsigned char)(((unsigned long)(b)) & 0xff))) << 8))`
- 4.6.2.36 `#define MAX_ID (252)`
- 4.6.2.37 `#define PING_INFO_FIRM_VER (2)`
- 4.6.2.38 `#define PING_INFO_MODEL_NUM (1)`
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- 4.6.2.40 `#define PRT1_PKT_ID (2)`
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4.7 main.cpp File Reference

Contains the Main of the program.

```
#include <QApplication>
#include "mainwindow.h"
```

Include dependency graph for main.cpp:



Functions

- int [main](#) (int argc, char *argv[])

4.7.1 Detailed Description

Contains the Main of the program.

4.7.2 Function Documentation

4.7.2.1 int main (int argc, char * argv[])

```

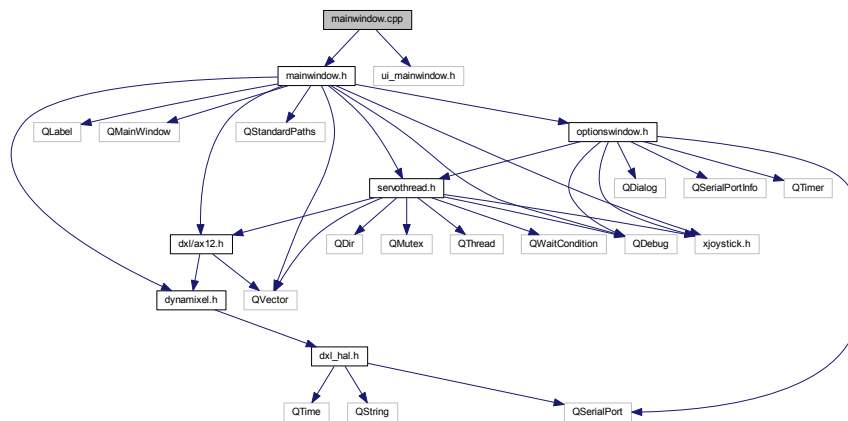
00009 {
00010     QApplication a(argc, argv);
00011     MainWindow w;
00012     w.show();
00013     return a.exec();
00014 }
```

4.8 mainwindow.cpp File Reference

Contains the [MainWindow](#) class implementation.

```
#include "mainwindow.h"
#include "ui_mainwindow.h"
```

Include dependency graph for mainWindow.cpp:



4.8.1 Detailed Description

Contains the [MainWindow](#) class implementation.

4.9 mainWindow.h File Reference

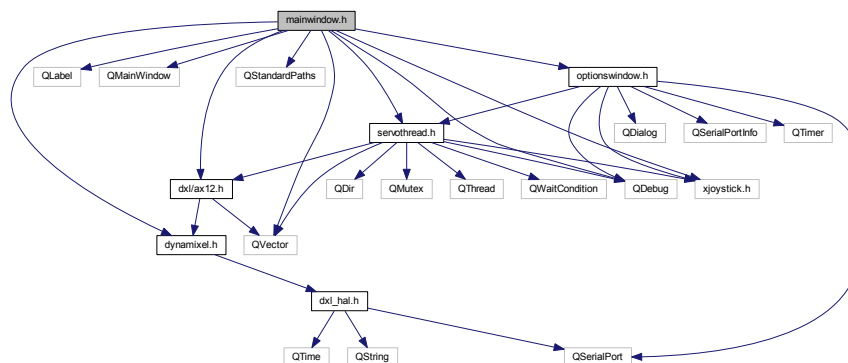
Contains the [MainWindow](#) class declaration.

```

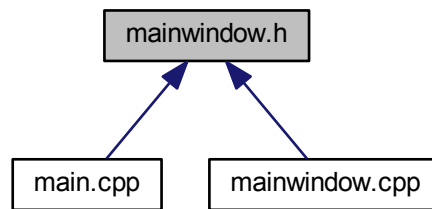
#include <QDebug>
#include <QLabel>
#include <QMainWindow>
#include <QVector>
#include <QStandardPaths>
#include <xjoystick.h>
#include "dxl/ax12.h"
#include "dxl/dynamixel.h"
#include "optionswindow.h"
#include "servothread.h"

```

Include dependency graph for mainWindow.h:



This graph shows which files directly or indirectly include this file:



Classes

- class [MainWindow](#)
Contains all the windows and other classes.

Namespaces

- [Ui](#)
Namespace to work with a User Interface Qt Form.

4.9.1 Detailed Description

Contains the [MainWindow](#) class declaration.

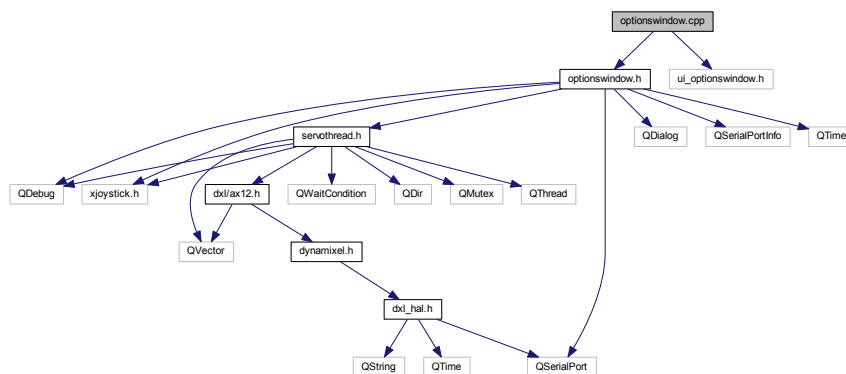
4.10 optionswindow.cpp File Reference

Contains the [OptionsWindow](#) class implementation.

```
#include "optionswindow.h"
```

```
#include "ui_optionswindow.h"
```

Include dependency graph for optionswindow.cpp:



4.10.1 Detailed Description

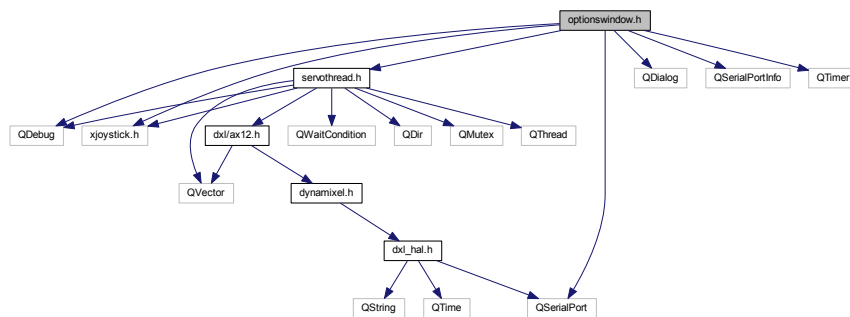
Contains the [OptionsWindow](#) class implementation.

4.11 optionswindow.h File Reference

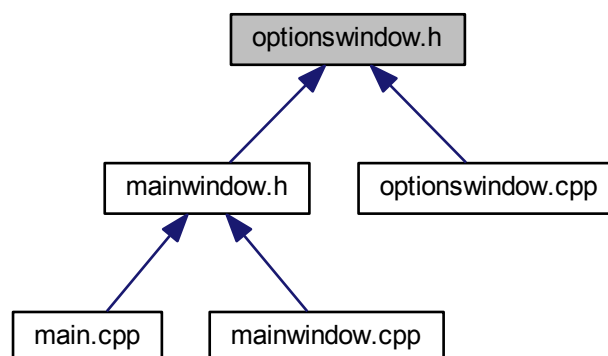
Contains the [OptionsWindow](#) class declaration.

```
#include <QDebug>
#include <QDialog>
#include <QSerialPort>
#include <QSerialPortInfo>
#include <QTimer>
#include <xjoystick.h>
#include "servothread.h"
```

Include dependency graph for optionswindow.h:



This graph shows which files directly or indirectly include this file:



Classes

- class [OptionsWindow](#)

Class used to handle a Window to set the options.

Namespaces

- [Ui](#)

Namespace to work with a User Interface Qt Form.

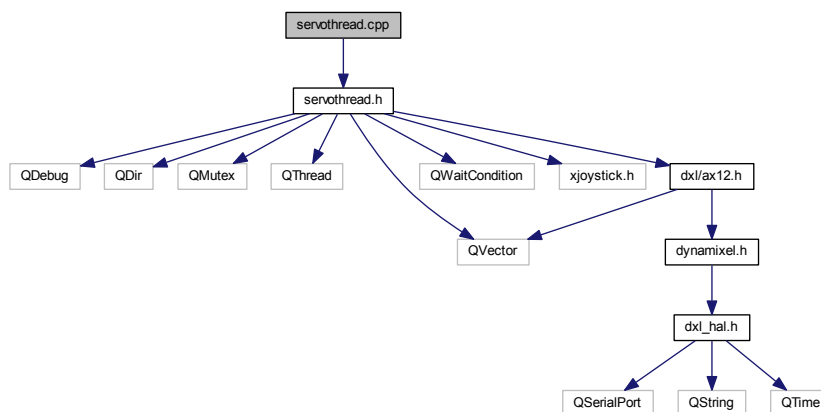
4.11.1 Detailed Description

Contains the [OptionsWindow](#) class declaration.

4.12 servothread.cpp File Reference

```
#include "servothread.h"
```

Include dependency graph for servothread.cpp:

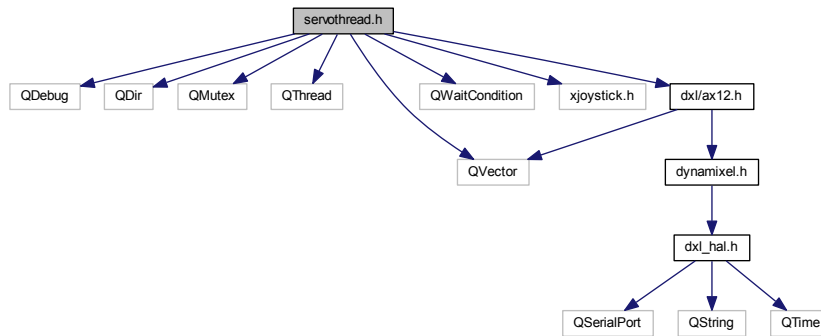


4.13 servothread.h File Reference

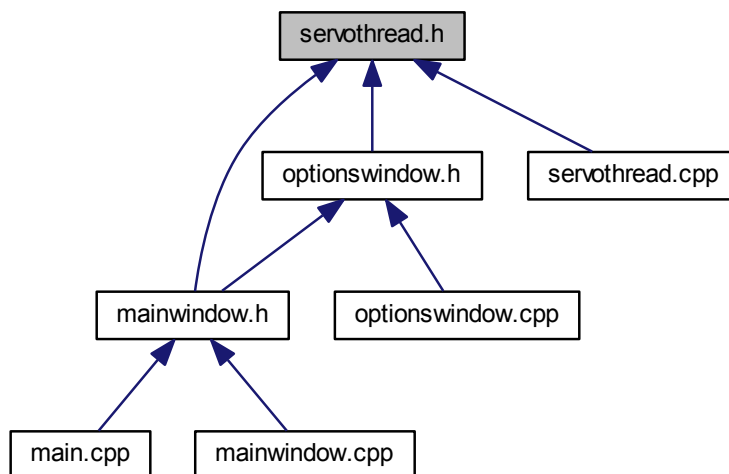
Contains the [ServoThread](#) class implementation.

```
#include <QDebug>
#include <QDir>
#include <QMutex>
#include <QThread>
#include <QVector>
#include <QWaitCondition>
#include <xjoystick.h>
#include "dxl/ax12.h"
```


Include dependency graph for servothread.h:



This graph shows which files directly or indirectly include this file:



Classes

- class [ServoThread](#)
The *ServoThread*'s class handles the communication between the delta robot servos and the PC.
- struct [ServoThread::Servo](#)
Struct for the *AX12* servos.

4.13.1 Detailed Description

Contains the [ServoThread](#) class implementation.

Contains the [ServoThread](#) class declaration.

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