

**MODBUS-RTU Protocol
Ichill 100
Release FW 4.4**

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1.	COMMAND DESCRIPTION
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READ HOLDING REGISTERS (0X03):

Slave Address	Function Code	Register Address (MSByte)	Register Address (LSByte)	Number of Registers (MSByte)	Number of Registers (LSByte)	CRC (LSByte)	CRC (MSByte)
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Slave Address: Defined the device address that received the answer of reading data.

Function Code: code of the desired function = 0x03

Register address: is the address of the first register to be read

Number of Registers: Defines the number of Elements (Register) that the device has to return (es. 3 = 3 Registers). **No more than 5 Elements allowed.**

CRC : Defined the CRC calculated for the frame data received and has to be used to verify the integrity of data received. It is calculated

The answer message has the following format:

Slave address	Function code	NumByte	Byte Data 1		Byte Data n	CRC (LSByte)	CRC (MSByte)
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NumByte: Defined the number of bytes followed without CRC.

ByteData: byte data buffer.

WRITE SINGLE REGISTERS (0X06):

The command has the following format:

Slave Address	Function Code	Register Address (MSByte)	Register Address (LSByte)	DATA (MSByte)	DATA (LSByte)	CRC (LSByte)	CRC (MSByte)
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Slave Address: Defined the device address that received the answer of reading data.

Function Code: code of the desired function = 0x06

Register address: is the address of the register to write to

Data: is the data to write

CRC : Defined the CRC calculated for the frame data received and has to be used to verify the integrity of data received. It is calculated

The answer message is an eco of the command you sent (it has the same format)

WRITE HOLDING REGISTER (0X10):

The command has the following format:

Slave address	Function Code	Register Address (MSByte)	Register Address (LSByte)	Number of Registers (MSByte)	Number of Registers (LSByte)	NumByte	DATA	CRC (LSByte)	CRC (MSByte)
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Slave Address: Defined the device address that received the answer of writing data.

Function Code: code of the desired function = 0x10

Register address: is the address of the first register to write to

Number of Registers. : Defines the number of registers to write to. **No more than 5 Elements is allowed.**

NumByte: Defined the number of bytes followed without CRC. The number of bytes has to be double respect the number of addressed Elements (NumByte = 2*Nreg).

CRC:

Defined the CRC calculated for the frame data received and has to be used to verify the integrity of data received.

The answer has the following format:

Slave Address	Function code	Register Address (MSByte)	Register Address (LSByte)	Number of Registers (MSByte)	Number of Registers (LSByte)	CRC (LSByte)	CRC (MSByte)
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√ **Parameters communication aspects (DIXELL CONTROLLERS):**

Communication between devices is managed by the RS485 (RS232 for XJ500) that is configured as follows:

Physical layer	=	RS485
Baud Rate	=	9600 bps
Data Length	=	8 bit
Parity	=	None
Stop Bit	=	1
START/STOP	=	silent interval 3 characters
MIN TIME BETWEEN TWO RETRY	=	500 msec

Slave addresses:

This field range is 1-247. Address 0 is used for the broadcast address. In this case the slave execute the command (only Write Holding Register command) but doesn't return some response

Exception code:

Dixell's devices answers with exception codes when they are not able to execute the last command received. The exception configuration is:

1. Not implemented function (0x01)

In this case is requested a function that device is not able to support. Es: every time master sends a function different from '0x03' or '0x10'

2. Not implemented area (0x02)

In this case is requested a resource absent in the device. Es: every time is requested a Logic Area absent.

3. Area index not valid (0x03)

In this case the value of the selected resource is out of range. Example:

- Every time is requested an Element of a Logic Area absent.
- More than 5 Elements requested.
- Writing a parameter out of range
- Writing in a Logic Area just reading.

4. Read/Write error (0x04)

The device didn't succeeded in reading or writing requested operation. Es: every time reading or writing operation (Ram, E2, RTC and etc) is not ending correctly.

5. Busy state for slave active (0x06)

The device can't execute requested operation because busy in another analogue operation. Master has to repeat the same request in another time.

The exception answer has the following format:

Slave address	Function code OR hex(80)	Exception code	CRC (LSByte)	CRC (MSByte)
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CRC

The CRC value is calculated (on the entire message) by the transmitting device, which appends the CRC to the message. The receiving device recalculates a CRC during receipt of the message and compares the calculated value to the actual value it received in the CRC field. If the two values are not equal, an error results. Here there is the code (in C format) to generate CRC.

```
#define MODBUS_GENERATOR 0xA001
Unsigned int CRC;
void ModbusCalcCRC(unsigned char* Frame,unsigned char LenFrame)
{
    unsigned char CntByte;
    unsigned char j;
    unsigned char bitVal;
    CRC = 0xFFFF;

    For(CntByte=0;CntByte<LenFrame;CntByte++)
        {
            CRC ^= Frame[CntByte];
            for(j=0;j<8;j++)
                {
                    bitVal = CRC & 0x0001;
                    CRC = CRC >> 1;
                    if(bitVal == 1)
                        CRC ^= MODBUS_GENERATOR;
                }
        }
}
```

NOTE:

To uniform interpretation mode of data, all data areas will have the following format:

WORD (single data register)															
MSByte							LSByte								
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

2.

IDENTIFICATION AND CONFIGURATION (reading)

REGISTER	DESCRIPTION	SIZE (word)	NOTE
0	<ul style="list-style-type: none"> Product family code Firmware Version 	1	MSByte = Product family code LSByte = Firmware Version
1	<ul style="list-style-type: none"> Instrument code 1 (MSWord) 	1	DIXELL code
2	<ul style="list-style-type: none"> Instrument code 2 (LSWord) 	1	DIXELL code
3	<ul style="list-style-type: none"> Serial number 1 (MSWord) 	1	MS WORD
4	<ul style="list-style-type: none"> Serial number 2 (LSWord) 	1	LS WORD
5	<ul style="list-style-type: none"> FW version date 	1	<ul style="list-style-type: none"> Day = bit15 / bit11 Month = bit10 / bit7 Year = bit6 / bit0
6	<ul style="list-style-type: none"> EEPROM descriptor 	1	MSWord always 0 – LSWORD with descriptor

DIXELL CODE FOR COMMERCIAL CODE: 'X'

Instrument code 1 (MSWord) HIGH BYTE ASCII code

Instrument code 1 (MSWord) LOW BYTE ASCII code

Instrument code 2 (LSWord) :

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Value from 0 to 999 (1000 is null value)										(ASCII code -hex(20))					

3.

PROBE VALUE & STATUS (reading)

REGISTER	DESCRIPTION	SIZE (word)	NOTE
256	• Probe 1 status (I°)	1	Probe 1 value
257	• Probe 1 status (II°)	1	Probe 1 status (Probe status table below)
258	• Probe 2 status (I°)	1	Probe 2 value
259	• Probe 2 status (II°)	1	Probe 2 status (Probe status table below)
260	• Probe 3 status (I°)	1	Probe 3 value
261	• Probe 3 status (II°)	1	Probe 3 status (Probe status table below)
262	• Probe 4 status (I°)	1	Probe 4 value
263	• Probe 4 status (II°)	1	Probe 4 status (Probe status table below)

PROBE STATUS TABLE

Byte	Description
Byte (H) Bit0-1-2-3	Engineering unit: 0=NC,1=°C,2=°F,3=RH%,4=PSI,5=BAR,6=Rpm,7=mA,8=A,9=mV,10=V 11,12,13,14,15=Not used.
Byte (H) bit 4	Probe resolution (1) decimal, (0) integer
Byte (H) bit 5-6-7	n.u.
Byte (L) bit 0	Probe error (1-1)
Byte (L) bit 1	
Byte (L)	n.u.

4.

Digital inputs status (reading)

REGISTER 512		DIGITAL INPUT ACTIVE IN THE DEVICE	
MSByte		LSByte	
<i>Bit0</i>	Winter regulation request (EI)	<i>bit0</i>	Compressor 1 overload (Tc1)
<i>Bit1</i>	Temperature regulation request (Ta)	<i>bit1</i>	Compressor 2 overload (Tc2)
<i>Bit2</i>	Humidity regulation request (Ua)	<i>bit2</i>	Fan overload
<i>Bit3</i>	Only ventilation (Fv)	<i>bit3</i>	Condensation water discharge (Ps)
<i>Bit4</i>	Defrost request (Ts)	<i>bit4</i>	Summer regulation request (EI)
<i>Bit5</i>	Flow switch (FI)	<i>bit5</i>	Remote On-Off (On)
<i>Bit6</i>	High pressure (Ph)	<i>bit6</i>	Dirty filter (Fi)
<i>Bit7</i>	Low pressure (Pl)	<i>bit7</i>	Air renewal request (Ri)

If bit = 0 the digital input is not active or not present

If bit = 1 the digital input is active (if present)

5.

MACHINE STATUS (reading – writing)

REGISTER 1280		MACHINE STATUS	
MSByte		LSByte	
<i>bit0</i>	Writing only: Watch Dog (reset of the Ichill)	<i>bit0</i>	Only writing: Watch Dog reset (reset of the Ichill)
<i>Bit1</i>		<i>bit1</i>	
<i>bit2</i>	Reading only: <ul style="list-style-type: none"> On status (bit=1) remote Off status (bit=0) 	<i>bit2</i>	Reading only: <ul style="list-style-type: none"> On status (bit=1) remote Off status (bit=0)
<i>bit3</i>	In reading: <ul style="list-style-type: none"> bit=0 stand-by or remote off bit=1 on chiller or heat pump In writing: only STD-BY is allowed (bit=0)	<i>bit3</i>	In reading: <ul style="list-style-type: none"> bit=0 stand-by or remote off bit=1 on chiller or heat pump In writing: only STD-BY is allowed (bit=1)
<i>bit4</i>	In reading: chiller status (bit=1, chiller ON) In writing: only chiller On allowed (bit=1, chiller ON)	<i>bit4</i>	In reading: chiller status (bit=1, chiller ON) In writing: only chiller On allowed (bit=1, chiller ON)
<i>bit5</i>	In reading: heat pump status (bit=1, heat pump ON) In writing: only heat pump ON allowed (bit=1, heat pump ON)	<i>bit5</i>	In reading: heat pump status (bit=1, heat pump ON) In writing: only heat pump ON allowed (bit=1, heat pump ON)
<i>bit6</i>	Reading only: temperature regulation on going (bit=1 regulation ongoing)	<i>Bit6</i>	Reading only: temperature regulation on going (bit=1 regulation ongoing)
<i>bit7</i>	Reading only: de-humidification/humidification regulation on going (bit=1 regulation ongoing)	<i>Bit7</i>	Reading only: de-humidification/humidification regulation on going (bit=1 regulation ongoing)

REGISTER 1281		MACHINE STATUS	
MSByte		LSByte	
<i>bit0</i>		<i>bit0</i>	
<i>Bit1</i>	Reading only: Defrost ongoing (bit=1)	<i>bit1</i>	Reading only: Defrost ongoing (bit=1)
<i>bit2</i>		<i>bit2</i>	
<i>bit3</i>		<i>bit3</i>	
<i>bit4</i>	In writing: buzzer silencing in case of alarm (bit=1)	<i>bit4</i>	In writing: buzzer silencing in case of alarm (bit=1)
<i>bit5</i>		<i>bit5</i>	
<i>bit6</i>		<i>Bit6</i>	
<i>bit7</i>	Only reading: dynamic set point enabled	<i>Bit7</i>	Only reading: dynamic set point enabled

Writing of machine status:

- allowed command WSR (write single register)
- allowed command WHR (write holding register) with number of registers = 1 (otherwise exception 3)
- Not allowed writings are not accepted with exception 3 (E.g.: Request to write element 1, Request to write dynamic set ..., Request to write not allowed bit)
- It is not possible to make Modbus command when the user is using the keyboard (Set displaying, Set programming input or parameters...) or in programming parameters or into functions menu, the device answers with exception 6.

6.**SET POINT (reading - writing)**

Register	
1536	Summer de-humidification set point
1537	Winter de-humidification set point
1538	Summer CO2 set point
1539	Winter CO2 set point
1540	Summer set point
1541	Winter set point
1542	Summer pre-treatment set point
1543	Winter pre-treatment set point
1544	Summer post-treatment set point
1545	Winter post-treatment set point
1546	humidification set point

7.**DIGITAL OUTPUT STATUS (reading)**

REGISTER 2048		RELAY OUTPUTS	
MSByte		LSByte	
<i>bit0</i>	Compressor 1 (CO)	<i>bit0</i>	Compressor 1 (CO)
<i>Bit1</i>	Compressor 2 (CO2)	<i>bit1</i>	Compressor 2 (CO2)
<i>bit2</i>	Supply fan (VE)	<i>bit2</i>	Supply fan (VE)
<i>bit3</i>	By-pass valve (Eb)	<i>bit3</i>	By-pass valve (Eb)
<i>bit4</i>	Defrost valve (Es)	<i>bit4</i>	Defrost valve (Es)
<i>bit5</i>	4-way valve (E4)	<i>bit5</i>	4-way valve (E4)
<i>bit6</i>	Indoor condenser valve (Ee)	<i>Bit6</i>	Indoor condenser valve (Ee)
<i>bit7</i>	Outdoor condenser valve (Ei)	<i>Bit7</i>	Outdoor condenser valve (Ei)

REGISTER 2049		RELAY OUTPUTS	
MSByte		LSByte	
<i>bit0</i>	En valve (En)	<i>bit0</i>	En valve (En)
<i>Bit1</i>	Alarm (Al)	<i>bit1</i>	Alarm (Al)
<i>bit2</i>	Renew fan / outside air dumper (Vr)	<i>bit2</i>	Renew fan / outside air dumper (Vr)
<i>bit3</i>	Recovery dumper (Rec)	<i>bit3</i>	Recovery dumper (Rec)
<i>bit4</i>	Condenser water pump (Po)	<i>bit4</i>	Condenser water pump (Po)
<i>bit5</i>	Pre-treatment valve (Vf)	<i>bit5</i>	Pre-treatment valve (Vf)
<i>bit6</i>	Pre-treatment water pump (Pf)	<i>Bit6</i>	Pre-treatment water pump (Pf)
<i>bit7</i>	Post-treatment valve / 1 st step heaters (Vc)	<i>Bit7</i>	Post-treatment valve / 1 st step heaters (Vc)

REGISTER 2050		RELAY OUTPUTS	
MSByte		LSByte	
<i>bit0</i>	Post-treatment water pump (Pc)	<i>bit0</i>	Post-treatment water pump (Pc)
<i>Bit1</i>	11 nd step heaters (Re2)	<i>bit1</i>	11 nd step heaters (Re2)
<i>bit2</i>	Humidifier (Um)	<i>bit2</i>	Humidifier (Um)
<i>bit3</i>	De-superheater water pump (Pd)	<i>bit3</i>	De-superheater water pump (Pd)
<i>bit4</i>	Fan second speed (Ve2)	<i>bit4</i>	Fan second speed (Ve2)
<i>bit5</i>	Condenser fan (VEC)	<i>bit5</i>	Condenser fan (VEC)
<i>bit6</i>	Step 1 compressor 1	<i>Bit6</i>	Step 1 compressor 1
<i>bit7</i>	Free cooling	<i>Bit7</i>	Free cooling

8.

ANALOGUE OUTPUT ONLY (read only)

REGISTER	DESCRIPTION	SIZE (word)	NOTE
2304	* I st Analogue output value (I°)	1	Condenser fan (CC) value (expressed in percentage of the maximum value)
2305	---	1	always 0
2306	* II nd Analogue output value (I°)	1	Air dumper (Sr) value (expressed in percentage of the maximum value)
2307	---	1	always 0
2308	* III rd Analogue output value (I°)	1	Pre-treatment valve (VFA) value (expressed in percentage of the maximum value)
2309	---	1	always 0
2310	* IV th Analogue output value (I°)	1	Post-treatment valve (VCA) value (expressed in percentage of the maximum value)
2311	---	1	always 0
2312	* V th Analogue output value (I°)	1	Humidity valve (Ud) value (expressed in percentage of the maximum value)
2313	---	1	always 0
2314	VI th Analogue output value (I°)	1	Free cooling value (expressed in percentage of the maximum value)
2315	---	1	always 0
2316	* VII th Analogue output value (I°)	1	Condenser fan value (expressed in percentage of the maximum value)
2317	---	1	always 0

9.

CLOCK (READING-WRITING)

REGISTER	DESCRIZIONE	SIZE (word)	NOTE
2816	• Seconds and minutes	1	MSByte = seconds LSByte = minutes
2817	• Hour and day of the week	1	MSByte = hour LSByte = day of the week (1-sunday 7-saturday)
2818	• Day and month	1	MSByte = day LSByte = month
2819	• Year	1	Year

- if the clock is not present the controller answers "exception 3"
- if the clock date is not properly read/write, the controller answers "exception 4"
- if the user is working on the controller (push some keys to read the set point, to enter the menu, to program the parameters,..., the controller answers "exception 6"

10. ALARM STATUS (reading - writing)

REGISTER 3328		ALARM LIST	
MSByte		LSByte	
<i>bit0</i>	Limit probe alarm (PBL)	<i>bit0</i>	Outside probe alarm (PBE)
<i>Bit1</i>	Antifreeze probe alarm (PBF)	<i>bit1</i>	Condenser probe alarm (PBV)
<i>bit2</i>	Antifreeze probe of recovery unit (PBFR)	<i>bit2</i>	Inlet water probe alarm (PBi)
<i>bit3</i>	Ambient air probe alarm (PBA)	<i>bit3</i>	Outlet water probe alarm (PBW)
<i>bit4</i>	Pre-treatment probe alarm (PBR)	<i>bit4</i>	Humidity probe alarm (PBU)
<i>bit5</i>	Post treatment probe alarm (PBO)	<i>bit5</i>	CO2 probe alarm (PBC)
<i>bit6</i>	Indoor defrost probe alarm (PBD)	<i>Bit6</i>	Condenser pressure alarm probe (PBP)
<i>bit7</i>	Outdoor defrost probe alarm (PBS)	<i>Bit7</i>	4..20mA probe alarm (PBM)

REGISTER 3329		ALARM LIST	
MSByte		LSByte	
<i>bit0</i>	Dynamic set point probe alarm (PBT)	<i>bit0</i>	Compressor 2 maintenance warning
<i>bit1</i>	Water flow probe alarm (l/h)	<i>bit1</i>	Supply fan maintenance warning (Ve)
<i>Bit2</i>	Water flow probe alarm (mc/h)	<i>bit2</i>	Air renew fan maintenance warning (Vr)
<i>bit3</i>	Configuration alarm ACF1	<i>bit3</i>	Condenser pump maintenance warning (Po)
<i>bit4</i>	Configuration alarm ACF2	<i>bit4</i>	Pre-treatment water pump maintenance warning (PF)
<i>bit5</i>	Configuration alarm ACF3	<i>bit5</i>	Post-treatment water pump maintenance warning (Pc)
<i>bit6</i>	Configuration alarm ACF4	<i>Bit6</i>	De-superheater water pump maintenance warning (Pd)
<i>bit7</i>	Compressor 1 maintenance warning	<i>Bit7</i>	Condenser fan maintenance warning (Vec)

REGISTER 3330		ALARM LIST	
MSByte		LSByte	
<i>bit0</i>	Clock alarm	<i>Bit0</i>	
<i>bit1</i>	Drain discharge water pump alarm	<i>bit1</i>	
<i>Bit2</i>	Max. limit temperature (PBI)	<i>bit2</i>	
<i>bit3</i>	Min. limit temperature (PBI)	<i>bit3</i>	
<i>bit4</i>	End defrost for maximum time	<i>bit4</i>	
<i>bit5</i>		<i>bit5</i>	
<i>bit6</i>	High temperature (PBr probe) for heat recovery unit	<i>bit6</i>	
<i>bit7</i>	Communication error with remote keyboard	<i>bit7</i>	

REGISTER 3331 / 3332		ALARM LIST	
MSB		LSB	
<i>bit0</i>		<i>bit0</i>	
<i>Bit1</i>		<i>bit1</i>	
<i>bit2</i>		<i>bit2</i>	
<i>bit3</i>		<i>bit3</i>	
<i>bit4</i>		<i>bit4</i>	
<i>bit5</i>		<i>bit5</i>	
<i>bit6</i>		<i>Bit6</i>	
<i>bit7</i>		<i>Bit7</i>	

REGISTER 3333		ALARM LIST (always manual reset)	
MSB		LSB	
<i>bit0</i>	Eeprom alarm	<i>bit0</i>	
<i>Bit1</i>	Clock alarm	<i>bit1</i>	
<i>bit2</i>		<i>bit2</i>	
<i>bit3</i>		<i>bit3</i>	
<i>bit4</i>		<i>bit4</i>	
<i>bit5</i>		<i>bit5</i>	
<i>bit6</i>		<i>Bit6</i>	
<i>bit7</i>		<i>Bit7</i>	

REGISTER 3334 / 3335 / 3336		ALARM LIST	
MSB		LSB	
<i>bit0</i>		<i>bit0</i>	
<i>Bit1</i>		<i>bit1</i>	
<i>bit2</i>		<i>bit2</i>	
<i>bit3</i>		<i>bit3</i>	
<i>bit4</i>		<i>bit4</i>	
<i>bit5</i>		<i>bit5</i>	
<i>bit6</i>		<i>Bit6</i>	
<i>bit7</i>		<i>Bit7</i>	

REGISTER 3337		ALARM LIST (automatic – manual reset)	
MSB		LSB	
<i>bit0</i>	Low pressure (pressostat)	<i>bit0</i>	High outlet water temperature
<i>Bit1</i>	High pressure (pressostat)	<i>bit1</i>	Low inlet water temperature
<i>bit2</i>	Compressor overload	<i>bit2</i>	High outlet water temperature
<i>bit3</i>	II nd compressor overload	<i>bit3</i>	Antifreeze
<i>bit4</i>	Fan overload	<i>bit4</i>	Antifreeze for unit with recovery
<i>bit5</i>	Low pressure (probe)	<i>bit5</i>	Flow switch
<i>bit6</i>	High pressure (probe)	<i>Bit6</i>	Water flow by probe
<i>bit7</i>	High inlet water temperature	<i>Bit7</i>	

Reading of forecasted logic elements allows to know system alarm.

Writing of logic element allow to reset a manual alarm:

- Is enabled by means of command WSR (write single register)
- Is enabled by means of command WSR WHR (write holding register) with number of registers = 1 (otherwise exception 3)
- Reset only 1 alarm per time. If it's requested to reset more than one alarm, the device resets only the one linked to the first alarm in the buffer (MSByte, LSByte).
- If the alarm is not present the device answers with exception 3
- If the it's not possible to reset the alarm device answers with exception 6
- If the keyboard is active (set displaying, Set programming input or parameters...) or in programming (parameters, set or RTC) or into functions menu, the device answers with exception 6.

NOTE: For any other general support for MODBUS standard communication please see <http://www.modbus.org/>

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