

# Ethernet Communication Protocol

Oxford Cryosystems Ltd

## Finding the 800 Series Oxford Cryosystems device on the network

The 800 Series Oxford Cryosystems controller broadcast its IP address, NetBIOS name and MAC address on port 30303. This information is sent as a UDP packet. The IP address is obtained from the properties of the UDP packet whereas the NetBIOS name and MAC address is sent in the packet data section. The first 16 bytes of the data section contains the NetBIOS name and the subsequent bytes contain the MAC address of the controller.

Note: Port 30303 should be opened in the firewall.

## Reading the Status packet

The status packets are issued by the 800 Series controller as UDP data packets. Reading status packets requires a UDP socket to be created using the controller's IP address and the command port 30304. The UDP status packets are sent with 1 second intervals.

Note: Port 30304 should be opened in the firewall.

The data section of a UDP status packets has the following structure:

HEADER\_BYTE1, HEADER\_BYTE2, DATA\_SIZE\_BYTE1, DATA\_SIZE\_BYTE2, ID\_BYTE1, ID\_BYTE2, VALUE\_BYTE1, VALUE\_BYTE2, ..., CHECKSUM\_BYTE1, CHECKSUM\_BYTE2, FOOTER\_BYTE1, FOOTER\_BYTE2

HEADER\_BYTE1, HEADER\_BYTE2 – unique 16-bit header

DATA\_SIZE\_BYTE1, DATA\_SIZE\_BYTE2 – data size in bytes (16 bit);

ID\_BYTE1, ID\_BYTE2 – 16 bit Param Id

VALUE\_BYTE1, VALUE\_BYTE2 – 16 bit Param Value

...

CHECKSUM\_BYTE1, CHECKSUM\_BYTE2 – 16-bit checksum calculated as simple 16-bit sum of all the ids and values

FOOTER\_BYTE1, FOOTER\_BYTE2 – unique 16-bit footer

The HEADER is defined as 0xAAAB and the FOOTER is defined as 0xABAA.

The list of possible Param Id values is described below:

ParamIdDeviceType 1000

ParamIdDeviceSubType 1001

ParamIdDeviceMinTemp 1002

ParamIdDeviceMaxTemp 1003  
ParamIdDeviceH8Firmware 1004  
ParamIdDeviceConnectedPeripherals 1005  
ParamIdDeviceSmartMode 1006  
ParamIdStartUpGasSensor 1010  
ParamIdStartUpEvapSensor 1011  
ParamIdStartUpGasHeat 1012  
ParamIdStartUpEvapHeat 1013  
ParamIdStartUpSuctSensor 1014  
ParamIdStartUpFlowCtrl 1015  
ParamIdStartUpEEPROM 1016  
ParamIdStartUpDeviceMatch 1017  
ParamIdStartUpSuctHeat 1018  
ParamIdStartUpTestSensor 1019  
ParamIdSetUpRGas 1020  
ParamIdSetUpSCGas 1021  
ParamIdSetUpREvap 1022  
ParamIdSetUpSCEvap 1023  
ParamIdSetUpRSuct 1024  
ParamIdSetUpSCSuct 1025  
ParamIdSetUpTestR 1026  
ParamIdSetUpDefaultEvapAdjust 1027  
ParamIdSetUpControllerNumber 1028  
ParamIdSetUpColdheadNumber 1029  
ParamIdSetUpCommissionDate 1030  
ParamIdSetUpHours 1031  
ParamIdSetUpInitialTemp 1032  
ParamIdSetUpDefaultUnits 1033  
ParamIdSetUpShutdownInfo 1034  
ParamIdLiveAdcChannel1 1040  
ParamIdLiveAdcChannel2 1041  
ParamIdLiveAdcChannel3 1042  
ParamIdLiveAdcChannel4 1043  
ParamIdLiveAdcHeater1 1044  
ParamIdLiveAdcHeater2 1045  
ParamIdLiveAdcHeater3 1046  
ParamIdStatusGasSetPoint 1050  
ParamIdStatusGasTemp 1051  
ParamIdStatusGasError 1052  
ParamIdStatusRunMode 1053  
ParamIdStatusPhaseId 1054  
ParamIdStatusRampRate 1055  
ParamIdStatusTargetTemp 1056  
ParamIdStatusEvapTemp 1057  
ParamIdStatusSuctTemp 1058  
ParamIdStatusRemaining 1059  
ParamIdStatusGasFlow 1060  
ParamIdStatusGasHeat 1061  
ParamIdStatusEvapHeat 1062  
ParamIdStatusAveSuctHeat 1063  
ParamIdStatusLinePressure 1064

ParamIdStatusAlarmCode 1065  
ParamIdStatusRunTime 1066  
ParamIdStatusEvapAdjust 1067  
ParamIdStatusTurboMode 1068  
ParamIdStatusAveGasHeat 1069  
ParamIdStatusSuctHeat 1070  
ParamIdStatusSuspended 1071  
ParamIdCommsCommandsReceived 1072  
ParamIdCommsCommandsMissed 1073  
ParamIdShutdownInfoLastCode 1080  
ParamIdShutdownInfoLastRunTime 1081  
ParamIdShutdownInfoErrorCode 1082  
ParamIdShutdownInfoErrorRunTime 1083  
ParamIdShutdownInfoErrorSampleTemp 1084  
ParamIdShutdownInfoErrorSetTemp 1085  
ParamIdShutdownInfoErrorEvapTemp 1086  
ParamIdShutdownInfoErrorSuctTemp 1087  
ParamIdShutdownInfoErrorGasHeat 1088  
ParamIdShutdownInfoErrorEvapHeat 1089  
ParamIdShutdownInfoErrorSuctHeat 1090  
ParamIdShutdownInfoErrorGasFlow 1091  
ParamIdShutdownInfoErrorBackPressure 1092  
ParamIdShutdownInfoErrorADC1 1093  
ParamIdShutdownInfoErrorADC2 1094  
ParamIdShutdownInfoErrorADC3 1095  
ParamIdShutdownInfoErrorADC4 1096  
ParamIdShutdownInfoCryodriveSpeed 1097  
ParamIdShutdownInfoCryodriveState 1098  
ParamIdFlowBlockFlowRate 1100  
ParamIdFlowBlockBackPressure 1101  
ParamIdFlowBlockSupplyPressure 1102  
ParamIdFlowBlockValveOpening 1103  
ParamIdFlowBlockFirmware 1104  
ParamIdFlowBlockSerial 1105  
ParamIdFlowBlockOuterFlow 1106  
ParamIdFlowBlockSelectedGas 1107  
ParamIdFlowBlockDetectedGas 1108  
ParamIdAutoFillSerial 1200  
ParamIdAutoFillFirmware 1201  
ParamIdAutoFillLNCOUNTS 1202  
ParamIdAutoFillLNLevel 1203  
ParamIdAutoFillCalibLow 1204  
ParamIdAutoFillCalibHigh 1205  
ParamIdAutoFillHeadStatus 1206  
ParamIdAutoFillRefillLevel 1207  
ParamIdAutoFillStopLevel 1208  
ParamIdAutoFillMode 1209  
ParamIdAutoFillSolenoidStatus 1210  
ParamIdAutoFillFaultState 1211  
ParamIdAutoFillTimeRemaining 1212  
ParamIdEthernetDHCPConfig 1300

ParamIdEthernetIPAddress1 1301  
ParamIdEthernetIPAddress2 1302  
ParamIdEthernetSubnetMask1 1303  
ParamIdEthernetSubnetMask2 1304  
ParamIdEthernetDefaultGateway1 1305  
ParamIdEthernetDefaultGateway2 1306  
ParamIdEthernetPrimaryDNS1 1307  
ParamIdEthernetPrimaryDNS2 1308  
ParamIdEthernetSecondaryDNS1 1309  
ParamIdEthernetSecondaryDNS2 1310  
ParamIdEthernetMACAddress1 1311  
ParamIdEthernetMACAddress2 1312  
ParamIdEthernetMACAddress3 1313  
ParamIdEthernetFirmware 1314  
ParamIdCryodriveSerial 1400  
ParamIdCryodriveFirmware 1401  
ParamIdCryodriveStatus 1402  
ParamIdCryodriveSavedState 1403  
ParamIdCryodriveAutoStatus 1404  
ParamIdCryodriveFaultState 1405  
ParamIdCryodriveCurrentState 1406  
ParamIdCryodriveStepperState 1407  
ParamIdCryodriveHighTTrip 1408  
ParamIdCryodriveLowTTrip 1409  
ParamIdCryodriveWaterTemp 1410  
ParamIdCryodriveHeReturnPressure 1411  
ParamIdCryodriveHeSupplyPressure 1412  
ParamIdCryodriveHoursSinceService 1413  
ParamIdCryodriveStepperOneSpeed 1414  
ParamIdCryodriveStepperTwoSpeed 1415  
ParamIdCryodrivePCSPOneVolts 1416  
ParamIdCryodrivePCSPTwoVolts 1417  
ParamIdCryodriveTotalHours 1418  
ParamIdCryodriveCooldownOneSpeed 1419  
ParamIdCryodriveCooldownOneTime 1420  
ParamIdCryodriveCooldownTwoSpeed 1421  
ParamIdCryodriveCooldownTwoTime 1422  
ParamIdCryodriveSteadyOneSpeed 1423  
ParamIdCryodriveSteadyTwoSpeed 1424  
ParamIdCryodriveCooldownOneElapsed 1425  
ParamIdCryodriveCooldownTwoElapsed 1426  
ParamIdCryodriveTripTime 1427  
ParamIdCryodriveBlowdownDuration 1428  
ParamIdCryodriveBlowdownInterval 1429  
ParamIdCryodriveLastTrip 1430  
ParamIdCryodriveLowPWarningStandby 1431  
ParamIdCryodriveLowPWarningRun 1432  
ParamIdCryodriveLowPTripMargin 1433  
ParamIdPumpUnitSerial 1500  
ParamIdPumpUnitFirmware 1501  
ParamIdPumpUnitStatus 1502

ParamIdPumpUnitBoardTemp 1503  
ParamIdPumpUnitPumpTemp 1504  
ParamIdPumpUnitSetPressure 1505  
ParamIdPumpUnitDeliveryPressure 1506  
ParamIdPumpUnitPumpSpeed 1507  
ParamIdPumpUnitPumpDrive 1508  
ParamIdPumpUnitPumpCurrent 1509  
ParamIdPumpUnitRunningMinsLo 1510  
ParamIdPumpUnitRunningMinsHi 1511  
ParamIdPumpUnitTotalMinsLo 1512  
ParamIdPumpUnitTotalMinsHi 1513  
ParamIdPumpUnitLastAlarm 1514  
ParamIdPumpUnitTripTime 1515  
ParamIdFrontPanelSerial 1600  
ParamIdFrontPanelFirmware 1601  
ParamIdFrontPanelScreenSaverTime 1602  
ParamIdFrontPanelUnits 1603  
ParamIdFrontPanelFavouriteTemp 1604  
ParamIdFrontPanelFavouriteRate 1605  
ParamIdFrontPanelShutdownTimer 1606  
ParamIdAuxPicFirmware 1700  
ParamIdAuxPicDeliveryPressure 1701  
ParamIdDryAirUnitSerial 1800  
ParamIdDryAirUnitFirmware 1801  
ParamIdDryAirUnitStatus 1802  
ParamIdDryAirUnitAlarm 1803  
ParamIdDryAirUnitFrequency 1804  
ParamIdDryAirUnitACVoltage 1805  
ParamIdDryAirUnitDCVoltage 1806  
ParamIdDryAirUnitCurrent 1807  
ParamIdDryAirUnitTemperature 1808  
ParamIdDryAirUnitPressure 1809  
ParamIdDryAirUnitLastAlarm 1810  
ParamIdDryAirUnitRunningMinsLo 1811  
ParamIdDryAirUnitRunningMinsHi 1812  
ParamIdDryAirUnitTotalHours 1813  
ParamIdCryoTelTc 1900  
ParamIdCryoTelTcSet 1901  
ParamIdCryoTelErrors 1902  
ParamIdCryoTelStop 1903  
ParamIdStatusCryodriveState 2000  
ParamIdStatusCryodriveSpeed 2001  
ParamIdStatusCryodriveAdjust 2002  
ParamIdStatusColdheadTemp 2010  
ParamIdStatusShieldTemp 2011  
ParamIdStatusVacuumGauge 2012  
ParamIdStatusNozzleTemp 2013  
ParamIdStatusSampleHeat 2014  
ParamIdStatusColdheadHeat 2015  
ParamIdStatusShieldHeat 2016  
ParamIdStatusNozzleHeat 2017

ParamIdStatusVacuumGaugePower 2018  
 ParamIdStatusAveSampleHeat 2019  
 ParamIdStatusAveNozzleHeat 2020  
 ParamIdStatusAutoFillMode 2021  
 ParamIdStatusAutoFillTimedInterval 2022  
 ParamIdStatusAutoFillTimedRemaining 2023  
 ParamIdStatusAutoFillTimedDelay 2024  
 ParamIdStatusSampleHolderTemp 2030  
 ParamIdStatusCryostatTemp 2031  
 ParamIdStatusSampleHolderPresent 2032  
 ParamIdStatusSelectedControlSensor 2033  
 ParamIdStatusElapsed 2034  
 ParamIdStatusSuctSetTemp 2035  
 ParamIdStatusNozzleSetTemp 2036  
 ParamIdStatusStatusMask1 2037  
 ParamIdStatusStatusMask2 2038  
 ParamIdStatusStatusMask3 2039  
 ParamIdStatusStatusMask4 2040  
 ParamIdStatusCollarTemp 2041  
 ParamIdStatusVacuumSensor 2042

### **Sending the Command packet**

The commands are sent to the 800 Series controller as UDP packets. Sending a command requires a UDP socket to be created using the controller's IP address and the command port 30305. The data section of the UDP packet must contain a valid command structure. Please see the list of commands accepted by the Oxford Cryosystems controller below.

Note: Port 30305 should be opened in the firewall.

### **Cryostream command packets**

The structure of a valid command consists of 7 bytes defined as follows:

**COMMAND\_ID (high byte), COMMAND\_ID (low byte), PARAM1 (high byte), PARAM1 (low byte), PARAM2 (high byte), PARAM2 (low byte), CHECKSUM\_BYTE**

The COMMAND ID is a 16-bit parameter and must be one of the following values:

```

CSCOMMAND_RESTART=10, /* Restart a Cryostream which has shutdown */
CSCOMMAND_RAMP=11, /* Ramp command identifier - parameters follow */
CSCOMMAND_PLAT=12, /* Plat command identifier - parameter follows */
CSCOMMAND_HOLD=13, /* Hold command identifier - enter programmed Hold */
CSCOMMAND_COOL=14, /* Cool command identifier - parameter follows */
CSCOMMAND_END=15, /* End command identifier - parameter follows */
CSCOMMAND_PURGE=16, /* Purge command identifier */
CSCOMMAND_PAUSE=17, /* Pause command identifier - enter temporary Hold */
CSCOMMAND_RESUME=18, /* Resume command identifier - exit temporary Hold */
CSCOMMAND_STOP=19, /* Stop command identifier */
CSCOMMAND_TURBO=20, /* Turbo command identifier - parameter follows */
CSCOMMAND_SETSTATUSFORMAT=40, /* Set status packet format. Parameter follows */
  
```

The CHECKSUM\_BYTE is an 8-bit sum of bytes.

The PARAM1 and PARAM2 are 16-bit numbers and contain the parameters associated with the particular command. In most of the above cases no parameters are required, and thus the command packet will contain zero values at the specified positions. For example, a command packet to stop the Cryostream would be created as follows:

```
Command_buffer = { 0, 19, 0, 0, 0, 0, 19 }; /* Create a Stop command packet */
```

For those commands requiring parameters, the PARAM1 and PARAM2 takes various forms, illustrated by the following examples. The valid parameter ranges for these commands are indicated below. If the command is unrecognised (Id invalid or Size inappropriate), illegal (parameter out of range) or inappropriate (e.g. the machine has shutdown), then it is simply ignored.

Example commands

### Turbo On

```
Command_buffer = { 0, 20, 0, 1, 0, 0, 19 }; /* Switch Turbo On */
```

The Ramp, Plat, Cool and End commands are a little more complicated, because the parameters which are passed are 16 bit integers. Temperatures are expressed in centi-Kelvin. This need to be assembled as illustrated in the following examples.

### Cool to 100 K

```
Command_buffer = { 0, 14, 39, 16, 0, 0, 69 }; /* Cool to 100 K */
```

### Ramp at 360 K/hour to 300 K

```
Command_buffer = { 0, 11, 1, 104, 117, 48, 25 }; /* Ramp at 360 K/hour to 300 K */
```

### Plat for 60 minutes

```
Command_buffer = { 0, 12, 0, 60, 0, 0, 72 }; /* Plat for 60 mins */
```

Parameter units and ranges

Command	Parameter	Units	Min	Max
CSCOMMAND_RAMP	RampRate	K/hour	1	360
CSCOMMAND_RAMP	TargetTemp	cK	8000	40000 for standard Cryostream, 50000 for Plus and Compact
CSCOMMAND_PLAT	Duration	minutes	1	1440 (=24 hours)
CSCOMMAND_COOL	TargetTemp	cK	8000	The current temperature - Cools must be downwards
CSCOMMAND_END	RampRate	K/hour	1	360
CSCOMMAND_TURBO	TurboOn	none	0	1 (any value other than 1 is treated as 0)