# ML4030-ACO

## MSA Compliant 100G

## CFP2-ACO Electrical Passive Loopback Modules

**Rev B**

**Revision 1.0**

## ML4030-ACO 4x32G Passive Loopback Module - Key Features

- ✓ Passive CFP2 loopback module, 4 TX & 4 RX Lanes operating at 32Gb/s per lane
- ✓ Programmable Power Dissipation up to 12 W covering all CFP2 power classes
- ✓ Custom Memory Maps
- ✓ RX_LOS-Alarm driven by TX_DIS control
- ✓ High performance Signal Integrity traces
- ✓ MSA compliant Digital Diagnostic and Monitoring Interface (DDMI)
- ✓ 3 Status LED indicator
- ✓ Built with advanced PCB material
- ✓ Temperature sensing
- ✓ Cut-Off Temperature preventing module overheating
- ✓ Hot Pluggable module

## LED Indicator

- ✓ **Green** (Solid): Signifies that the module is operating in high power mode.
- ✓ **Red** (Solid): Signifies the module is operating in low power mode.
- ✓ **Green**/**Red** (Blinking): Signifies that the module is overheated and the temperature high alarm is asserted.

## Operating Conditions

| Recommended Operation Conditions | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Notes/Conditions** | **Min** | **Typ** | **Max** | **Units** |
| **Operating Temperature** | $T_A$ | | 0 | | 85 | °C |
| **Supply Voltage** | VCC | Main Supply Voltage | 3.00 | 3.3 | 3.60 | V |
| **Data Rate** | $R_b$ | Guaranteed to work up to 32 Gbps per lane | 0 | | 100 | Gbps |
| **Input/Output Load Resistance** | RL | AC-Coupled, Differential | 90 | 100 | 110 | Ω |
| **Power Class** | | Programmable to Emulate all power classes | 0 | | 12 | W |

# Table of Contents


1. General Description ..... 4
2. Functional Description ..... 4
   2.1 Management Data Interface – MDIO ..... 4
   2.2 Initialization Sequence ..... 6
   2.3 GLB_ALRM ..... 7
   2.4 CFP Register Set ..... 8
   2.5 User NVR Restore and Save Function (0xB004) ..... 9
   2.6 PRG_ALRMs ..... 10
   2.7 RX_LOS ..... 10
   2.8 Temperature Monitor ..... 11
   2.9 Insertion Counter ..... 12
   2.10 Programmable Power Dissipation & Thermal Emulation ..... 12
   2.11 Cut-Off Temperature ..... 12
   2.12 Module Control and Status Registers ..... 13
3. CFP2-ACO Pin Allocation ..... 15
   3.1 High Speed Signals ..... 16
4. NVR Register preloaded values ..... 16

# 1. General Description

The ML4030-ACO is a CFP2 passive electrical loopback module with a hot pluggable form factor designed for high speed testing applications for CFP2 host ports. The ML4030-ACO is designed for 100 Gigabit Ethernet applications and provides 4x32G RX and TX lanes, a MDIO module management interface and all the CFP2 MSA hardware signals.

The ML4030-ACO loops 4-lane of 32 Gb/s transmit data from the Host back to 4-lane of 32 GB/s receive data to the Host.

The ML4030-ACO provides programmable power dissipation up to 12W allowing the module to emulate all the CFP2 power classes.

# 2. Functional Description

## 2.1 Management Data Interface – MDIO

The ML4030-ACO supports the MDIO interface specified in IEEE802.3 Clause 45.

The ML4030-ACO implements a dedicated MDIO logic block in the to handle the high rate MDIO data and a CFP register space that is divided into two register groups, the Non-Volatile Registers (NVR) and the Volatile Registers (VR). The NVRs are connected to a Non-Volatile Memory device (NVM) for ID/Configuration data storage. Over the internal bus system, the VRs are connected to a device that executes the Host control commands and reports various Digital Diagnostic Monitoring (DDM) data. Please Note that in the rest of this document, independently of implementation, CFP registers are also referred as NVRs or VRs.

The ML4030-ACO specifications are the following:

- ✓ Supports MDC rates up to 4MHz.
- ✓ CFP Registers at MDIO Device Address1 as specified by CFP MSA.
- ✓ Supports various Physical Addresses thus allowing communication with many modules plugged to the same Host with different Port Addresses (PRT_ADDR0-2) assigned.

CFP registers use fast memory to shadow the NVM data and the DDM data. The shadow registers decouple the Host-side timing requirements from the module's internal processing, timing, and hardware control circuit introduced latency.

CFP shadow register set meets the following requirements:

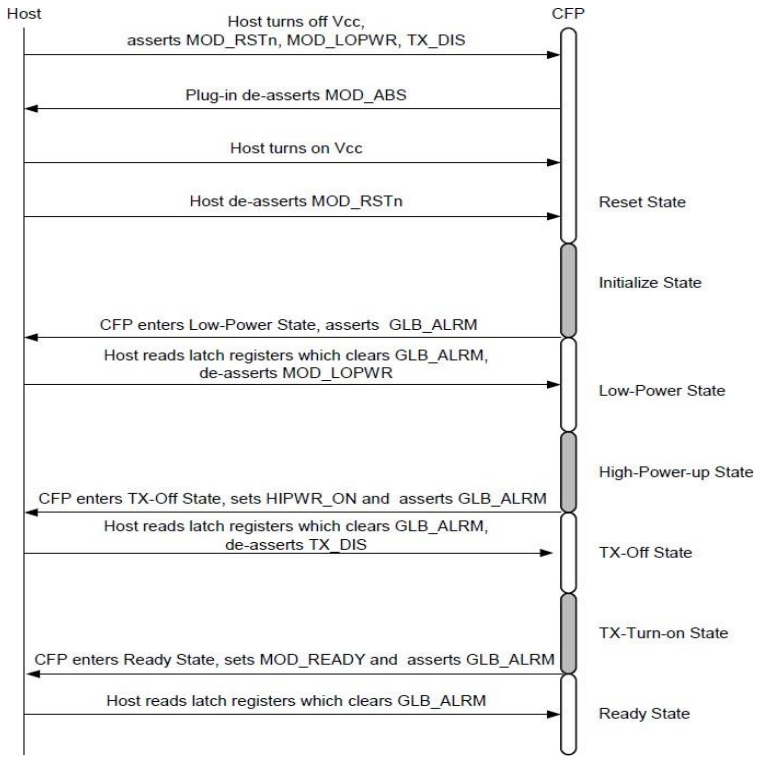
- ✓ It supports dual access from the Host and from module internal operations such as NVM and

DDM data transfers.

- ✓ It supports continuous Host access (read and write) with fast access memory at maximum MDC rates of 4 MHz.
- ✓ It allows the uploading of NVM content into the CFP shadow register during module initialization. Data saving from CFP shadow register to NVM is supported.
- ✓ It supports the DDM data update periodically during the whole operation of the module. The maximum data refresh period is 1ms (real time temperature monitoring).
- ✓ It supports the whole CFP register set including all NVRs and VRs.
- ✓ Incomplete or otherwise corrupted MDIO bus transactions are purged from memory and disregarded.
- ✓ The port address is allowed to change on the fly without a module reset.

## 2.2 Initialization Sequence

The Startup sequence for the ML4030-ACO is defined below:




MOD_RSTs assertion drives the CFP2 module to a reset state, at this stage the MDIO interface will be held in a high impedance state, the Host will read 'FFFF'h from any address, while host write operations will have no effect.

Upon the de-assertion of MOD_RSTs, the CFP2 module exists to an initialize state which is a transient state.

The Initialization time required is less than one second. When Initialization state is completed, the CFP2 module will enter a Low-Power state; at this point MDIO becomes available for R/W operations.

## 2.3 GLB_ALRM

Below is the flowchart for GLB_ALRM signal during CFP states transitions:

GLB _ALRM is de-asserted during Reset and Initialize state, it is asserted in Low-Power, High-Power-up, TX-Off and TX-Turn-on states, then de-asserted again when Ready state is reached. GLB_ALRMn is the hardware pin, and is the inverse of GLB_ALRM.

The below example can be run in order to check for correct module initialization and GLB_ALRM signal:

- Assert MOD_LOPWR and TX_DIS, DeassertMOD_RSTn : GLB_ALRMn should be HIGH (module in Reset state)
- Assert MOD_RSTn (module exits Reset state into Low Power state) : GLB_ALRMn should be LOW
- Deassert MOD_LOPWR (module exits Low Power into TX-Off state) : GLB_ALRMn should stay LOW
- Deassert TX_DIS (module enters Ready state): GLB_ALRMn should go HIGH MDIO Signals, Addressing and Frame Structure.

**Port Address (PRTADR)**

As per the port address used, the module will work on any MDIO Physical port address which can be set by the HW input signals PRTADR [2:0]. So when using 2 or more CFP2 slots, each of them can be configured to a different Port Address.

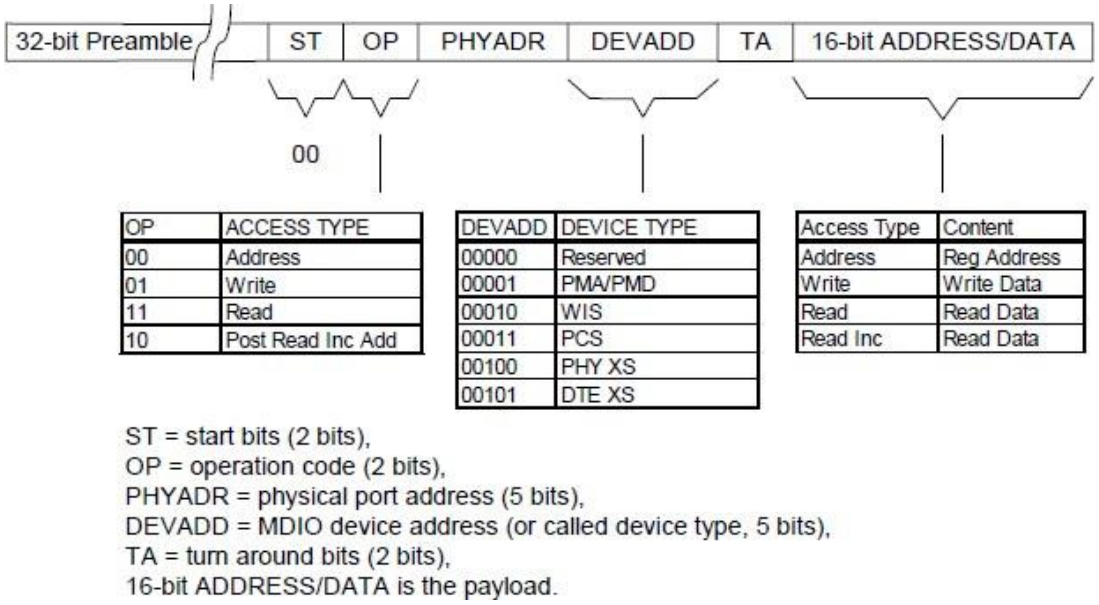
| | | | |
|---|---|---|---|
| PRTADR0 | MDIO Physical Port address bit 0 | I | 1.2V LVCMOS |
| PRTADR1 | MDIO Physical Port address bit 1 | I | 1.2V LVCMOS |
| PRTADR2 | MDIO Physical Port address bit 2 | I | 1.2V LVCMOS |

**Device Address (DEVADD)**

MDIO Device Address consists of 5 bits that are sent in MDIO frames, CFP MSA specifies that CFP register Set should be addressed using Device Address = 1, Thus CFP register space is available in the ML4030-ACO on D.A=1.

**MDIO Frame**

The Below Frame shows all segments of an MDIO Packet, PHYADR are the 5 bits Physical Address and DEVADD are the 5 bits Device Address.




| OP | ACCESS TYPE |
|---|---|
| 00 | Address |
| 01 | Write |
| 11 | Read |
| 10 | Post Read Inc Add |

| DEVADD | DEVICE TYPE |
|---|---|
| 00000 | Reserved |
| 00001 | PMA/PMD |
| 00010 | WIS |
| 00011 | PCS |
| 00100 | PHY XS |
| 00101 | DTE XS |

| Access Type | Content |
|---|---|
| Address | Reg Address |
| Write | Write Data |
| Read | Read Data |
| Read Inc | Read Data |

ST = start bits (2 bits),
OP = operation code (2 bits),
PHYADR = physical port address (5 bits),
DEVADD = MDIO device address (or called device type, 5 bits),
TA = turn around bits (2 bits),
16-bit ADDRESS/DATA is the payload.

## 2.4 CFP Register Set

All registers are supported in memory map (Refer to table below), the set of registers starting from 0x8000 to 0x9F00 are implemented as NVR registers and all these registers are always read from NVM during initialization and mapped to corresponding addresses.

All VR (Volatile Registers) are set to zero or to MSA defaults value upon module initialization.

The NVR values are saved to NVM by calling the SAVE NVR function. The base ID registers are initially set, but the user can change them if required.

| Hex Addr Start | Hex Addr End | Access Type | Allocated Size | Data Bit Width | Description |
|---|---|---|---|---|---|
| 0000 | 7FFF | N/A | 32768 | N/A | Reserved for IEEE 802.3 use. |
| 8000 | 807F | RO | 128 | 8 | CFP NVR 1. Basic ID Registers |
| 8080 | 80C6 | RO | 128 | 8 | CFP NVR 2. Extended ID Registers |
| 80C8 | 80FF | | | | CFP NVR 2. MSA-100GLH Module Alarm/Warning Threshold Registers |
| 8100 | 817F | RO | 128 | 8 | CFP NVR 3. Network Lane BOL Measurement Registers |
| 8180 | 81FF | RO | 128 | 8 | CFP NVR 4. MSA-100GLH Extended ID Registers |
| 8200 | 83FF | RO | 4x128 | N/A | MSA Reserved |
| 8400 | 847F | RO | 128 | 8 | Vendor NVR 1. Vendor Data Registers |
| 8480 | 84FF | RO | 128 | 8 | Vendor NVR 2. Vendor Data Registers |
| 8500 | 87FF | RO | 6x128 | N/A | MSA Reserved |
| 8800 | 887F | RW | 128 | 8 | User NVR 1. User Data Registers |
| 8880 | 88FF | RW | 128 | 8 | User NVR 2. User Data Registers |
| 8900 | 8EFF | RO | 12x128 | N/A | MSA Reserved |
| 8F00 | 8FFF | N/A | 2x128 | N/A | Reserved for User private use |
| 9000 | 9FFF | N/A | 4096 | N/A | Reserved for Vendor private use |
| B000 | B07F | RW | 128 | 16 | MSA-100GLH Module VR1: Command/Setup/Control/FAWS Registers |
| B080 | B17F | RO | 2x128 | N/A | MSA Reserved |
| B180 | B2FF | RW | 3x128 | 16 | MSA-100GLH Module VR1: Network Lane FAWS/Status Registers |
| B300 | B57F | RW | 5x128 | 16 | MSA-100GLH Module VR2: Network Lane Control/Data Registers |
| B580 | B5FF | RW | 128 | 16 | MSA-100GLH Module VR2: Network Lane OTN/FEC-related Registers (Optional) |
| B600 | B6FF | RW | 2x128 | 16 | MSA-100GLH Module VR1: Host Lane FAWS/Control/Status Registers |
| B700 | B77F | RW | 2x128 | 16 | MSA-100GLH Module VR1: Host Lane OTN/FEC-related Registers (Optional) |
| B780 | B7FF | RO | 128 | N/A | MSA Reserved |
| B800 | BAFF | RW | 6x128 | 16 | MSA-100GLH Module VR2: Network Lane Modulation Format Dependent Registers (Optional-informative) |
| BB00 | BBFF | RO | 2x128 | N/A | MSA Reserved |
| BC00 | BFFF | RW | 1024 | 16 | MSA-100GLH Module VR2: Bulk Data Transfer Registers |

## 2.5 User NVR Restore and Save Function (0xB004)

To write permanently to User NVR registers (0x8000→ 0x9F00) the host shall use the "Save" function to store the shadowed NVR data into underlying NVM. The host only needs to perform a single save operation to copy the entire User NVR shadow registers to the underlying NVM after finishing editing the data.

Upon power-up or reset the User NVR shadow registers are "Restored" with NVM values. Note that the Restore function will overwrite the NVR shadow registers, losing any host-written values in them that have occurred since the last Save to the underlying NVM.

The NVR Access Control Register (**B004h**) provides the Save function for Host to save the User NVRs content.

Bit 5 in NVR Access Control Register is designated for User NVR save command.

**A "1" written to bit 5 in register B004h initiates a User NVR Save**.

| Hex Adr | Size | Access Type | Bit | Register Name Bit Field Name | Description | Init Value |
|---|---|---|---|---|---|---|
| **B004** | 1 | | | **NVR Access Control** | | 0000h |
| | | WO | 5 | User Restore and Save command | 1: Save the user NVR section | 0 |

**So to call the user NVR save command user can write 0x0020 into register 0xB004.**
**The Save NVR duration is around 0.5 seconds. When this function is called it should be followed by a 0.5 second time wait.**
During this process the user can't write or read CFP registers.

## 2.6 PRG_ALRMs

The signals HIPWR_ON, MOD_READY, and MOD_FAULT are CFP internally generated signals and are defaults of the programmable alarm pins PRG_ALRMx.
The Following Table lists the corresponding functions for each of the PRG_ALRMs.

| NAME | ALARM SOURCE | VALUE |
|---|---|---|
| HIPWR_ON | Module high-power-on indicator. PRG_ALRM1 MSA default. | 0: Module not high powered up<br>1: Module high power up completed |
| MOD_READY | MOD_READY, module startup sequence done, PRG_ALRM2 MSA default. | 0: Not done<br>1: Done |
| MOD_FAULT | Fault detected. PRG_ALRM3 MSA default. | 0: No Fault<br>1: Fault |

For testing purposes, PRG_ALRM3 can be manually controlled via bit 0 of register 0x9405.

| Hex Adr | Size | Access Type | Bit | Register Name Bit Field Name | Description | Init Value |
|---|---|---|---|---|---|---|
| **9405** | 1 | | | **PRG_ALRM control register** | | 0000h |
| | | RW | 0 | PRG_ALRM3 | 0: De-assert PRG_ALRM3 pin<br>1: Assert PRG_ALRM3 pin | 0 |

## 2.7 RX_LOS

The ML4030-ACO initially implements RX_LOS to follow TX_DIS input, assuming that in a loopback module, when the host transmitters are disabled, no data should be received thus leading to RX_LOS condition.

| Hex Adr | Size | Access Type | Bit | Register Name Bit Field Name | Description | Init Value |
|---|---|---|---|---|---|---|
| **9404** | 1 | | | **Custom Alarms** | | 0000h |
| | | RW | 0 | Prog RX_LOS | 0: RX_LOS default operation (RX_LOS= TX_DIS)<br>1: Programmable RX_LOS (driven as per Soft RX_LOS bit) | 0 |
| | | RW | 1 | Soft RX_LOS | 0: RX_LOS HW signal set to LOW | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | 1: RX_LOS HW signal set to High | |

## 2.8 Temperature Monitor

The alarms and warnings of the CFP2 Loopback are listed in the tables below. Alarms and Warnings are set in register 0xB01F in bits 8,9,10 and 11, and are continuously asserted and de-asserted when the corresponding alarms/warnings occur. addresses 0x8080, 0x8082, 0x8084, and 0x8086 are reference registers for temperature alarms and warnings, they contain the default values (HA:75, HW:65, LW:2 and LA:0) and can be changed when desired. The module is continuously reading the temperature and storing its value in Register 0xB02F.

When the temperature reaches the High Alarm values, the module front LED indicator will begin blinking.

| Hex Adr | Size | Access Type | Bit | Register Name<br>Bit Field Name | Description | LSB Unit |
|---|---|---|---|---|---|---|
| **8080** | 2 | RW | 7~0 | **Temp High Alarm Threshold** | These thresholds are a signed 16-bit integer with LSB = 1/256 of a degree Celsius representing a range from -128 to + 127 255/256 degree C. MSA valid range is between –40 and +125C." MSB stored at low address, LSB stored at high address. | 1/256 degC |
| **8082** | 2 | RW | 7~0 | **Temp High Warning Threshold** | | |
| **8084** | 2 | RO | 7~0 | **Temp Low Warning Threshold** | | |
| **8086** | 2 | RO | 7~0 | **Temp Low Alarm Threshold** | | |

| Hex Adr | Size | Access Type | Bit | Register Name<br>Bit Field Name | Description | Init Value |
|---|---|---|---|---|---|---|
| **B01F** | 1 | RO | | **Module Alarms and Warnings 1** | | 0000h |
| | | | 11 | Mod Temp High Alarm | Mod temp high Alarm<br>0: Normal, 1: Asserted | 0 |
| | | | 10 | Mod Temp High Warning | Mod temp high Warning<br>0: Normal, 1: Asserted | 0 |
| | | | 9 | Mod Temp Low Warning | Mod temp high Warning<br>0: Normal, 1: Asserted | 0 |
| | | | 8 | Mod Temp Low Alarm | Mod temp Low Alarm<br>0: Normal, 1: Asserted | 0 |

| Hex Adr | Size | Access Type | Bit | Register Name<br>Bit Field Name | Description | Init Value |
|---|---|---|---|---|---|---|
| **B02F** | 1 | RO | | **Module Temp Monitor A/D Value** | Internally measured temperature in degrees Celsius, a 16-bit signed integer with LSB = 1/256 of a degree Celsius, representing a total range from -128 to + 127 255/256 degC. MSA valid range is between –40 and +125C. Accuracy shall be better than +/- 3 degC over the whole temperature range. | 0000h |

## 2.9 Insertion Counter

The Insertion counter contains the number of times the module was plugged in a host. The insertion counter is incremented every time the module enters an initializing sequence, as it is nonvolatile it is always saved, and can be read anytime from register 0x9400.

| Hex Adr | Size | Access Type | Bit | Register Name Bit Field Name | Description | LSBUnit |
|---|---|---|---|---|---|---|
| **9400** | 1 | | | **Insertion Counter** | | |
| | | RO | 0~7 | Insertion Count | Number of times the modules was plugged in a host | 1 insertion |

## 2.10 Programmable Power Dissipation & Thermal Emulation

Register 0x9401 is used for PWM control over MDIO. It is an 8 bit data register.

The consumed power changes accordingly when the value in this register is changed (only when in high power mode). In Low power mode the module automatically turns off PWM.

The values written in this register can be stored by calling the Save NVR function, thus the user can permanently change the initial power consumed in high power mode when the module is powered up by setting the register value and calling the Save NVR function.

The PWM can also be used for module thermal emulation. The module contains a thermal spot positioned where the optical transceivers usually are in an optical module that is heated relative to the related PWM register.

Note that the led starts blinking when the temperature high alarm is reached.

| Hex Adr | Size | Access Type | Bit | Register Name Bit Field Name | Description | Init Value |
|---|---|---|---|---|---|---|
| **9401** | 1 | | | **PWM** | | |
| | | RW | 0~7 | PWM | 0x00 to 0xFF corresponding to 0 to 12W power cons | 0 |

## 2.11 Cut-Off Temperature

To avoid overheating the module, a Cut-Off Temperature is defined in Register 0x9402.

The module is continuously monitoring the temperature and checking its value against the Cut-Off temperature. A Temperature Cut-Off register is defined at address 0x9402, once the module temperature reaches the cut-off temperature, the PWM will automatically turn off in order to prevent overheating. Once the module gets below cut-off value of the temperature, the PWM goes back to its previous value.

The Maximum allowed Cut-Off temperature for the ML4030-ACO is 85degC, so even if the value stored in register 0x9402 is higher than 85 the module will still Cut-Off power at 85degC, in case the value stored in 0x9402 is lower than 85 then it will be adopted instead of the default value.

| Hex Adr | Size | Access Type | Bit | Register Name<br>Bit Field Name | Description | DefultValue |
|---|---|---|---|---|---|---|
| **9402** | 1 | | | **Temp Cut-Off** | | |
| | | RW | 0~7 | Cut-Off Value | 0x00 to 0x55 (0 to 85degC) | 0x55 |

## 2.12 Module Control and Status Registers

The below registers are implemented, and can be checked for module State and Control.

| Hex Adr | Size | Access Type | Bit | Register Name<br>Bit Field Name | Description | Init Value |
|---|---|---|---|---|---|---|
| **B010** | 1 | | | **Module General Control** | | 0000h |
| | | RO | 15 | Soft Module Reset | Register bit for module reset function. Writing a 0 to this bit has no effect regardless it was 0 or 1 previously.<br>1: Module reset assert | 0 |
| | | RW | 14 | Soft Module Low Power | Register bit for module low power function.<br>1: Assert | 0 |
| | | RW | 13 | Soft TX_Disable | Register bit for TX Disable function.<br>1: Assert | 0 |
| | | RO | 12-10 | Reserved | | 0 |
| | | RW | 9 | Soft GLB_ALRM Test | Command bit for software forced test signal. When this bit is asserted it generates GLB_ALRM signal.<br>1: Assert | 0 |
| | | RO | 8-6 | Reserved | | 0 |
| | | RO | 5 | TX_DIS Pin State | Logical state of the TX_DIS pin.<br>1: Assert. | 0 |
| | | RO | 4 | MOD_LOPWR Pin State | Logical state of the MOD_LOPWR pin.<br>1: Assert. | 0 |
| | | RO | 3 | PRG_CNTL3 Pin State | Logical state of the PRG_CNTL3 pin | 0 |
| | | RO | 2 | PRG_CNTL2 Pin State | Logical state of the PRG_CNTL2 pin | 0 |
| | | RO | 1 | PRG_CNTL1 Pin State | Logical state of the PRG_CNTL1 pin | 0 |
| | | RO | 0 | Reserved | | 0 |

| Hex Adr | Size | Access Type | Bit | Register Name<br>Bit Field Name | Description | Init Value |
|---|---|---|---|---|---|---|
| **B016** | 1 | | | **Module State** | | 0000h |
| | | RO | 15~9 | Reserved | | 0 |
| | | | 8 | High-Power-down State | 1: Corresponding state is active. Word value = 0100h. | 0 |
| | | | 7 | TX-Turn-off State | 1: Corresponding state is active. Word value = 0080h. | 0 |
| | | | 6 | Fault State | 1: Corresponding state is active. Word value = 0040h. | 0 |
| | | | 5 | Ready State | 1: Corresponding state is active. Word value = 0020h. | 0 |
| | | | 4 | TX-Turn-on State | 1: Corresponding state is active. Word value = 0010h. | 0 |
| | | | 3 | TX-Off State | 1: Corresponding state is active. Word value = 0008h. | 0 |
| | | | 2 | High-Power-up State | 1: Corresponding state is active. Word value = 0004h. | 0 |
| | | | 1 | Low-Power State | 1: Corresponding state is active. Word value = 0002h. | 0 |
| | | | 0 | Initialize State | 1: Corresponding state is active. Word value = 0001h. | 0 |

| Hex Adr | Size | Access Type | Bit | Register Name<br>Bit Field Name | Description | Init Value |
|---|---|---|---|---|---|---|
| **B01D** | 1 | | | **Module General Status** | | |
| | | RO | 1 | HIPWR_ON | Status bit representing the condition of module in high power status. FAWS Type is not applicable.<br>0: Module is not in high power on status,<br>1: Module is in high powered on status. | 0 |

# 3. CFP2-ACO Pin Allocation

CFP2-ACO class 3 pin mapping is adopted for the ML4030-ACO; the same pin mapping is compatible for using it as an Electrical loopback module for classes 1, 2 and 3.

| | CFP2-ACO Bottom: Class 3 | | CFP2-ACO Top: Class 3 |
|---|---|---|---|
| 1 | GND | 104 | GND |
| 2* | X OUTER PHASE DITHER | 103* | XI PHASE DITHER |
| 3* | Y OUTER PHASE DITHER | 102 | N.C. |
| 4 | GND | 101 | GND |
| 5* | TX X POL. TAP | 100* | TX_XIp (RF Mapping [0,0,0]) |
| 6* | TX Y POL. TAP | 99* | TX_XIn (RF Mapping [0,0,0]) |
| 7 | 3.3V_GND | 98 | GND |
| 8 | 3.3V_GND | 97* | TX_XQp (RF Mapping [0,0,0]) |
| 9 | 3.3V | 96* | TX_XQn (RF Mapping [0,0,0]) |
| 10 | 3.3V | 95 | GND |
| 11 | 3.3V | 94 | N.C. |
| 12 | 3.3V | 93* | XQ PHASE DITHER |
| 13 | 3.3V_GND | 92 | GND |
| 14 | 3.3V_GND | 91* | YI PHASE DITHER |
| 15 | VND_IO_A | 90 | N.C. |
| 16 | VND_IO_B | 89 | GND |
| 17 | PRG_CNTL1 | 88* | TX_YIp (RF Mapping [0,0,0]) |
| 18 | PRG_CNTL2 | 87* | TX_YIn (RF Mapping [0,0,0]) |
| 19 | PRG_CNTL3 | 86 | GND |
| 20 | PRG_ALRM1 | 85* | TX_YQp (RF Mapping [0,0,0]) |
| 21 | PRG_ALRM2 | 84* | TX_YQn (RF Mapping [0,0,0]) |
| 22 | PRG_ALRM3 | 83 | GND |
| 23 | GND | 82 | N.C. |
| 24* | TX_DIS (PRG_CNTL) | 81* | YQ PHASE DITHER |
| 25* | RX_LOS (PRG_ALRM) | 80 | GND |
| 26 | MOD_LOPWR | 79* | (REFCLKn-Terminated) |
| 27 | MOD_ABS | 78* | (REFCLKp-Terminated) |
| 28 | MOD_RSTn | 77 | GND |
| 29 | GLB_ALRMn | 76* | TX X-POL POWER DITHER |
| 30 | GND | 75* | TX Y-POL POWER DITHER |
| 31 | MDC | 74 | GND |
| 32 | MDIO | 73* | RX_XIp (RF Mapping [0,0,0]) |
| 33 | PRTADR0 | 72* | RX_XIn (RF Mapping [0,0,0]) |
| 34 | PRTADR1 | 71 | GND |
| 35 | PRTADR2 | 70* | RX_XQp (RF Mapping [0,0,0]) |
| 36 | VND_IO_C | 69* | RX_XQn (RF Mapping [0,0,0]) |
| 37 | VND_IO_D | 68 | GND |
| 38 | VND_IO_E | 67* | Rx MGC XI |
| 39 | 3.3V_GND | 66* | Rx MGC XQ |
| 40 | 3.3V_GND | 65 | GND |
| 41 | 3.3V | 64* | Rx MGC YI |
| 42 | 3.3V | 63* | Rx MGC YQ |
| 43 | 3.3V | 62 | GND |
| 44 | 3.3V | 61* | RX_YIp (RF Mapping [0,0,0]) |
| 45 | 3.3V_GND | 60* | RX_YIn (RF Mapping [0,0,0]) |
| 46 | 3.3V_GND | 59 | GND |
| 47* | TX XI TAP | 58* | RX_YQp (RF Mapping [0,0,0]) |
| 48* | TX XQ TAP | 57* | RX_YQn (RF Mapping [0,0,0]) |
| 49 | GND | 56 | GND |
| 50* | TX YI TAP | 55* | PM-SYNC |
| 51* | TX YQ TAP | 54* | TX POST POL. MUX TAP |
| 52 | GND | 53 | GND |

## 3.1 High Speed Signals

High speed signals are electrically looped back from the TX side to the RX side of the module, all differential TX pairs are connected to the corresponding RX pairs, and the signals are AC coupled as specified by CFP MSA HW specs.

The Passive traces connecting TX to RX pairs are designed to support a data rate up to 32 Gbps.

# 4. NVR Register preloaded values

The following table shows the values preloaded by Multilane to the NVR registers as Basic and extended ID registers.

The vendor part number **ML4030-ACO-2** set at registers 8034h to 803Fh identify a Rev B module.

| Address | Hex | Decimal | ASCII | MSA Description |
|---|---|---|---|---|
| CFP NVR 1 32768(8000h) | 0x14 | 20 | | Module Identifier |
| CFP NVR 1 32769(8001h) | 0x20 | 32 | | Extended Identifier |
| CFP NVR 1 32770(8002h) | 0x00 | 0 | | Connector Type Code |
| CFP NVR 1 32771(8003h) | 0x00 | 0 | | Ethernet Application Code |
| CFP NVR 1 32772(8004h) | 0x00 | 0 | | Fiber Channel Application Code |
| CFP NVR 1 32773(8005h) | 0x00 | 0 | | Copper Link Application Code |
| CFP NVR 1 32774(8006h) | 0x00 | 0 | | SONET/SDH Application Code |
| CFP NVR 1 32775(8007h) | 0x00 | 0 | | OTN Application Code |
| CFP NVR 1 32776(8008h) | 0x1F | 31 | | Additional Capable Rates Supported |
| CFP NVR 1 32777(8009h) | 0x44 | 68 | D | Number of Lanes Supported |
| CFP NVR 1 32778(800Ah) | 0xC4 | 196 | ? | Media Properties |
| CFP NVR 1 32779(800Bh) | 0x00 | 0 | | Maximum Network Lane Bit Rate |
| CFP NVR 1 32780(800Ch) | 0xA0 | 160 | ? | Maximum Host Lane Bit Rate |
| CFP NVR 1 32781(800Dh) | 0x00 | 0 | | Maximum Single Mode Optical Fiber Length |
| CFP NVR 1 32782(800Eh) | 0x00 | 0 | | Maximum Multi-Mode Optical Fiber Length |
| CFP NVR 1 32783(800Fh) | 0x00 | 0 | | Maximum Copper Cable Length |
| CFP NVR 1 32784(8010h) | 0x00 | 0 | | Transmitter Spectral Characteristics 1 |
| CFP NVR 1 32785(8011h) | 0x00 | 0 | | Transmitter Spectral Characteristics 2 |
| CFP NVR 1 32786(8012h) | 0x00 | 0 | | Minimum Wavelength per Active Fiber |
| CFP NVR 1 32787(8013h) | 0x00 | 0 | | Minimum Wavelength per Active Fiber |
| CFP NVR 1 32788(8014h) | 0x00 | 0 | | Maximum Wavelength per Active Fiber |
| CFP NVR 1 32789(8015h) | 0x00 | 0 | | Maximum Wavelength per Active Fiber |
| CFP NVR 1 32790(8016h) | 0x00 | 0 | | Maximum per Lane Optical Width |
| CFP NVR 1 32791(8017h) | 0x00 | 0 | | Maximum per Lane Optical Width |
| CFP NVR 1 32792(8018h) | 0x44 | 68 | D | Device Technology 1 |
| CFP NVR 1 32793(8019h) | 0x00 | 0 | | Device Technology 2 |
| CFP NVR 1 32794(801Ah) | 0x00 | 0 | | Signal Code |

| | | | | | |
|---|---|---|---|---|---|
| CFP NVR 1 32795(801Bh) | 0x00 | 0 | | | Maximum Total Optical Output Power per Connector |
| CFP NVR 1 32796(801Ch) | 0x00 | 0 | | | Maximum Optical Input Power per Network Lane |
| CFP NVR 1 32797(801Dh) | 0x46 | 70 | F | | Maximum Power Consumption |
| | | | | | |
| CFP NVR 1 32798(801Eh) | 0x05 | 5 | | | Maximum Power Consumption in Low Power Mode |
| CFP NVR 1 32799(801Fh) | 0x55 | 85 | U | | Maximum Operating Case Temp Range |
| CFP NVR 1 32800(8020h) | 0x00 | 0 | | | Minimum Operating Case Temp Range |
| CFP NVR 1 32801(8021h) | 0x4D | 77 | M | | Vendor Name |
| CFP NVR 1 32802(8022h) | 0x55 | 85 | U | | Vendor Name |
| CFP NVR 1 32803(8023h) | 0x4C | 76 | L | | Vendor Name |
| CFP NVR 1 32804(8024h) | 0x54 | 84 | T | | Vendor Name |
| CFP NVR 1 32805(8025h) | 0x49 | 73 | I | | Vendor Name |
| CFP NVR 1 32806(8026h) | 0x4C | 76 | L | | Vendor Name |
| CFP NVR 1 32807(8027h) | 0x41 | 65 | A | | Vendor Name |
| CFP NVR 1 32808(8028h) | 0x4E | 78 | N | | Vendor Name |
| CFP NVR 1 32809(8029h) | 0x45 | 69 | E | | Vendor Name |
| CFP NVR 1 32810(802Ah) | 0x20 | 32 | | | Vendor Name |
| CFP NVR 1 32811(802Bh) | 0x53 | 83 | S | | Vendor Name |
| CFP NVR 1 32812(802Ch) | 0x41 | 65 | A | | Vendor Name |
| CFP NVR 1 32813(802Dh) | 0x4C | 76 | L | | Vendor Name |
| CFP NVR 1 32814(802Eh) | 0x20 | 32 | | | Vendor Name |
| CFP NVR 1 32815(802Fh) | 0x20 | 32 | | | Vendor Name |
| CFP NVR 1 32816(8030h) | 0x20 | 32 | | | Vendor Name |
| CFP NVR 1 32817(8031h) | 0x00 | 0 | | | Vendor OUI |
| CFP NVR 1 32818(8032h) | 0x00 | 0 | | | Vendor OUI |
| CFP NVR 1 32819(8033h) | 0x00 | 0 | | | Vendor OUI |
| CFP NVR 1 32820(8034h) | 0x4D | 77 | M | | Vendor Part Number |
| CFP NVR 1 32821(8035h) | 0x4C | 76 | L | | Vendor Part Number |
| CFP NVR 1 32822(8036h) | 0x34 | 52 | | 4 | Vendor Part Number |
| CFP NVR 1 32823(8037h) | 0x30 | 48 | | 0 | Vendor Part Number |
| CFP NVR 1 32824(8038h) | 0x33 | 51 | | 3 | Vendor Part Number |
| CFP NVR 1 32825(8039h) | 0x30 | 48 | | 0 | Vendor Part Number |
| CFP NVR 1 32826(803Ah) | 0x2D | 45 | - | | Vendor Part Number |
| CFP NVR 1 32827(803Bh) | 0x41 | 65 | A | | Vendor Part Number |
| CFP NVR 1 32828(803Ch) | 0x43 | 67 | C | | Vendor Part Number |
| CFP NVR 1 32829(803Dh) | 0x4F | 79 | O | | Vendor Part Number |
| CFP NVR 1 32830(803Eh) | 0x2D | 45 | - | | Vendor Part Number |
| CFP NVR 1 32831(803Fh) | 0x32 | 50 | | 2 | Vendor Part Number |
| CFP NVR 1 32832(8040h) | 0x20 | 32 | | | Vendor Part Number |
| CFP NVR 1 32833(8041h) | 0x20 | 32 | | | Vendor Part Number |
| CFP NVR 1 32834(8042h) | 0x20 | 32 | | | Vendor Part Number |
| CFP NVR 1 32835(8043h) | 0x20 | 32 | | | Vendor Part Number |

| | | | | |
|---|---|---|---|---|
| CFP NVR 1 32836(8044h) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32837(8045h) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32838(8046h) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32839(8047h) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32840(8048h) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32841(8049h) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32842(804Ah) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32843(804Bh) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32844(804Ch) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32845(804Dh) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32846(804Eh) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32847(804Fh) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32848(8050h) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32849(8051h) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32850(8052h) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32851(8053h) | 0x20 | 32 | | Vendor Serial Number |
| CFP NVR 1 32852(8054h) | 0x32 | 50 | 2 | Date Code |
| CFP NVR 1 32853(8055h) | 0x30 | 48 | 0 | Date Code |
| CFP NVR 1 32854(8056h) | 0x31 | 49 | 1 | Date Code |
| CFP NVR 1 32855(8057h) | 0x35 | 53 | 5 | Date Code |
| CFP NVR 1 32856(8058h) | 0x30 | 48 | 0 | Date Code |
| CFP NVR 1 32857(8059h) | 0x36 | 54 | 6 | Date Code |
| CFP NVR 1 32858(805Ah) | 0x30 | 48 | 0 | Date Code |
| | | | | |
| CFP NVR 1 32859(805Bh) | 0x02 | 2 | | Date Code |
| CFP NVR 1 32860(805Ch) | 0x00 | 0 | | Lot Code |
| CFP NVR 1 32861(805Dh) | 0x00 | 0 | | Lot Code |
| CFP NVR 1 32862(805Eh) | 0x00 | 0 | | CLEI Code |
| CFP NVR 1 32863(805Fh) | 0x00 | 0 | | CLEI Code |
| CFP NVR 1 32864(8060h) | 0x00 | 0 | | CLEI Code |
| CFP NVR 1 32865(8061h) | 0x00 | 0 | | CLEI Code |
| CFP NVR 1 32866(8062h) | 0x00 | 0 | | CLEI Code |
| CFP NVR 1 32867(8063h) | 0x00 | 0 | | CLEI Code |
| CFP NVR 1 32868(8064h) | 0x00 | 0 | | CLEI Code |
| CFP NVR 1 32869(8065h) | 0x00 | 0 | | CLEI Code |
| CFP NVR 1 32870(8066h) | 0x00 | 0 | | CLEI Code |
| CFP NVR 1 32871(8067h) | 0x00 | 0 | | CLEI Code |
| CFP NVR 1 32872(8068h) | 0x0E | 14 | | CFP MSA Hardware Specification Revision Number |
| CFP NVR 1 32873(8069h) | 0x16 | 22 | | CFP MSA Management Interface Specification Revision |
| | | | | |
| CFP NVR 1 32874(806Ah) | 0x02 | 2 | | Module Hardware Version Number |
| CFP NVR 1 32875(806Bh) | 0x00 | 0 | | Module Hardware Version Number |

| | | | | |
|---|---|---|---|---|
| CFP NVR 1 32876(806Ch) | 0x01 | 1 | | Module Firmware Version Number |
| CFP NVR 1 32877(806Dh) | 0x00 | 0 | | Module Firmware Version Number |
| CFP NVR 1 32878(806Eh) | 0x00 | 0 | | Digital Diagnostic Monitoring Type |
| CFP NVR 1 32879(806Fh) | 0x01 | 1 | | Digital Diagnostic Monitoring Capability 1 |
| CFP NVR 1 32880(8070h) | 0x00 | 0 | | Digital Diagnostic Monitoring Capability 2 |
| CFP NVR 1 32881(8071h) | 0x80 | 128 | ? | Module Enhanced Options |
| CFP NVR 1 32882(8072h) | 0x01 | 1 | | Maximum High-Power-up Time |
| CFP NVR 1 32883(8073h) | 0x01 | 1 | | Maximum TX-Turn-on Time |
| CFP NVR 1 32884(8074h) | 0x00 | 0 | | Host Lane Signal Spec |
| CFP NVR 1 32885(8075h) | 0x00 | 0 | | Heat Sink Type |
| CFP NVR 1 32886(8076h) | 0x01 | 1 | | Maximum TX-Turn-off Time |
| CFP NVR 1 32887(8077h) | 0x01 | 1 | | Maximum High-Power-down Time |
| CFP NVR 1 32888(8078h) | 0x00 | 0 | | Module Enhanced Options 2 |
| CFP NVR 1 32889(8079h) | 0xA3 | 163 | ? | Transmitter Monitor Clock Options |
| CFP NVR 1 32890(807Ah) | 0xA3 | 163 | ? | Receiver Monitor Clock Options |
| CFP NVR 1 32891(807Bh) | 0x00 | 0 | | Reserved |
| CFP NVR 1 32892(807Ch) | 0x00 | 0 | | Reserved |
| CFP NVR 1 32893(807Dh) | 0x00 | 0 | | Reserved |
| CFP NVR 1 32894(807Eh) | 0x00 | 0 | | Reserved |
| CFP NVR 1 32895(807Fh) | 0x00 | 0 | | CFP NVR 1 Checksum |
| CFP NVR 2 32896(8080h) | 0x4B | 75 | K | Transceiver Temp High Alarm Threshold |
| CFP NVR 2 32897(8081h) | 0x00 | 0 | | Transceiver Temp High Alarm Threshold |
| CFP NVR 2 32898(8082h) | 0x41 | 65 | A | Transceiver Temp High Warning Threshold |
| CFP NVR 2 32899(8083h) | 0x00 | 0 | | Transceiver Temp High Warning Threshold |
| CFP NVR 2 32900(8084h) | 0x05 | 5 | | Transceiver Temp Low Warning Threshold |
| CFP NVR 2 32901(8085h) | 0x00 | 0 | | Transceiver Temp Low Warning Threshold |
| CFP NVR 2 32902(8086h) | 0x00 | 0 | | Transceiver Temp Low Alarm Threshold |
| CFP NVR 2 32903(8087h) | 0x00 | 0 | | Transceiver Temp Low Alarm Threshold |
| CFP NVR 2 32904(8088h) | 0x00 | 0 | | VCC High Alarm Threshold |
| CFP NVR 2 32905(8089h) | 0x00 | 0 | | VCC High Alarm Threshold |
| CFP NVR 2 32906(808Ah) | 0x00 | 0 | | VCC High Warning Threshold |
| CFP NVR 2 32907(808Bh) | 0x00 | 0 | | VCC High Warning Threshold |
| CFP NVR 2 32908(808Ch) | 0x00 | 0 | | VCC Low Warning Threshold |
| CFP NVR 2 32909(808Dh) | 0x00 | 0 | | VCC Low Warning Threshold |
| CFP NVR 2 32910(808Eh) | 0x00 | 0 | | VCC Low Alarm Threshold |
| CFP NVR 2 32911(808Fh) | 0x00 | 0 | | VCC Low Alarm Threshold |

| | | | |
|---|---|---|---|
| CFP NVR 2 32912(8090h) | 0x00 | 0 | SOA Bias Current High Alarm Threshold |
| CFP NVR 2 32913(8091h) | 0x00 | 0 | SOA Bias Current High Alarm Threshold |
| CFP NVR 2 32914(8092h) | 0x00 | 0 | SOA Bias Current High Warning Threshold |
| CFP NVR 2 32915(8093h) | 0x00 | 0 | SOA Bias Current High Warning Threshold |
| CFP NVR 2 32916(8094h) | 0x00 | 0 | SOA Bias Current Low Warning Threshold |
| CFP NVR 2 32917(8095h) | 0x00 | 0 | SOA Bias Current Low Warning Threshold |
| CFP NVR 2 32918(8096h) | 0x00 | 0 | SOA Bias Current Low Alarm Threshold |
| CFP NVR 2 32919(8097h) | 0x00 | 0 | SOA Bias Current Low Alarm Threshold |
| CFP NVR 2 32920(8098h) | 0x00 | 0 | Auxiliary 1 Monitor High Alarm Threshold |
| CFP NVR 2 32921(8099h) | 0x00 | 0 | Auxiliary 1 Monitor High Alarm Threshold |
| CFP NVR 2 32922(809Ah) | 0x00 | 0 | Auxiliary 1 Monitor High Warning Threshold |
| CFP NVR 2 32923(809Bh) | 0x00 | 0 | Auxiliary 1 Monitor High Warning Threshold |
| CFP NVR 2 32924(809Ch) | 0x00 | 0 | Auxiliary 1 Monitor Low Warning Threshold |
| CFP NVR 2 32925(809Dh) | 0x00 | 0 | Auxiliary 1 Monitor Low Warning Threshold |
| CFP NVR 2 32926(809Eh) | 0x00 | 0 | Auxiliary 1 Monitor Low Alarm Threshold |
| CFP NVR 2 32927(809Fh) | 0x00 | 0 | Auxiliary 1 Monitor Low Alarm Threshold |
| CFP NVR 2 32928(80A0h) | 0x00 | 0 | Auxiliary 2 Monitor High Alarm Threshold |
| CFP NVR 2 32929(80A1h) | 0x00 | 0 | Auxiliary 2 Monitor High Alarm Threshold |
| CFP NVR 2 32930(80A2h) | 0x00 | 0 | Auxiliary 2 Monitor High Warning Threshold |
| CFP NVR 2 32931(80A3h) | 0x00 | 0 | Auxiliary 2 Monitor High Warning Threshold |
| CFP NVR 2 32932(80A4h) | 0x00 | 0 | Auxiliary 2 Monitor Low Warning Threshold |
| CFP NVR 2 32933(80A5h) | 0x00 | 0 | Auxiliary 2 Monitor Low Warning Threshold |
| CFP NVR 2 32934(80A6h) | 0x00 | 0 | Auxiliary 2 Monitor Low Alarm Threshold |
| CFP NVR 2 32935(80A7h) | 0x00 | 0 | Auxiliary 2 Monitor Low Alarm Threshold |
| CFP NVR 2 32936(80A8h) | 0x00 | 0 | Laser Bias Current High Alarm Threshold |
| CFP NVR 2 32937(80A9h) | 0x00 | 0 | Laser Bias Current High Alarm Threshold |
| CFP NVR 2 32938(80AAh) | 0x00 | 0 | Laser Bias Current High Warning Threshold |
| CFP NVR 2 32939(80ABh) | 0x00 | 0 | Laser Bias Current High Warning Threshold |
| CFP NVR 2 32940(80ACh) | 0x00 | 0 | Laser Bias Current Low WarningThreshold |
| CFP NVR 2 32941(80ADh) | 0x00 | 0 | Laser Bias Current Low WarningThreshold |
| CFP NVR 2 32942(80AEh) | 0x00 | 0 | Laser Bias Current Low Alarm Threshold |
| CFP NVR 2 32943(80AFh) | 0x00 | 0 | Laser Bias Current Low Alarm Threshold |
| CFP NVR 2 32944(80B0h) | 0x00 | 0 | Laser Output Power High Alarm Threshold |
| CFP NVR 2 32945(80B1h) | 0x00 | 0 | Laser Output Power High Alarm Threshold |
| CFP NVR 2 32946(80B2h) | 0x00 | 0 | Laser Output Power High Warning Threshold |
| CFP NVR 2 32947(80B3h) | 0x00 | 0 | Laser Output Power High Warning Threshold |
| CFP NVR 2 32948(80B4h) | 0x00 | 0 | Laser Output Power Low Warning Threshold |
| CFP NVR 2 32949(80B5h) | 0x00 | 0 | Laser Output Power Low Warning Threshold |
| CFP NVR 2 32950(80B6h) | 0x00 | 0 | Laser Output Power Low Alarm Threshold |
| CFP NVR 2 32951(80B7h) | 0x00 | 0 | Laser Output Power Low Alarm Threshold |
| CFP NVR 2 32952(80B8h) | 0x00 | 0 | Laser Temperature High Alarm Threshold |
| CFP NVR 2 32953(80B9h) | 0x00 | 0 | Laser Temperature High Alarm Threshold |

| | | | |
|---|---|---|---|
| CFP NVR 2 32954(80BAh) | 0x00 | 0 | Laser Temperature High WarningThreshold |
| CFP NVR 2 32955(80BBh) | 0x00 | 0 | Laser Temperature High Warning Threshold |
| CFP NVR 2 32956(80BCh) | 0x00 | 0 | Laser Temperature Low Warning Threshold |
| CFP NVR 2 32957(80BDh) | 0x00 | 0 | Laser Temperature Low Warning Threshold |
| CFP NVR 2 32958(80BEh) | 0x00 | 0 | Laser Temperature Low Alarm Threshold |
| CFP NVR 2 32959(80BFh) | 0x00 | 0 | Laser Temperature Low Alarm Threshold |
| CFP NVR 2 32960(80C0h) | 0x00 | 0 | Receive Optical Power High Alarm Threshold |
| CFP NVR 2 32961(80C1h) | 0x00 | 0 | Receive Optical Power High Alarm Threshold |
| CFP NVR 2 32962(80C2h) | 0x00 | 0 | Receive Optical Power High Warning Threshold |
| CFP NVR 2 32963(80C3h) | 0x00 | 0 | Receive Optical Power High Warning Threshold |
| CFP NVR 2 32964(80C4h) | 0x00 | 0 | Receive Optical Power Low Warning Threshold |
| CFP NVR 2 32965(80C5h) | 0x00 | 0 | Receive Optical Power Low Warning Threshold |
| CFP NVR 2 32966(80C6h) | 0x00 | 0 | Receive Optical Power Low Alarm Threshold |
| CFP NVR 2 32967(80C7h) | 0x00 | 0 | Receive Optical Power Low Alarm Threshold |
| CFP NVR 2 32968(80C8h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32969(80C9h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32970(80CAh) | 0x00 | 0 | Reserved |
| CFP NVR 2 32971(80CBh) | 0x00 | 0 | Reserved |
| CFP NVR 2 32972(80CCh) | 0x00 | 0 | Reserved |
| CFP NVR 2 32973(80CDh) | 0x00 | 0 | Reserved |
| CFP NVR 2 32974(80CEh) | 0x00 | 0 | Reserved |
| CFP NVR 2 32975(80CFh) | 0x00 | 0 | Reserved |
| CFP NVR 2 32976(80D0h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32977(80D1h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32978(80D2h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32979(80D3h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32980(80D4h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32981(80D5h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32982(80D6h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32983(80D7h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32984(80D8h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32985(80D9h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32986(80DAh) | 0x00 | 0 | Reserved |
| CFP NVR 2 32987(80DBh) | 0x00 | 0 | Reserved |
| CFP NVR 2 32988(80DCh) | 0x00 | 0 | Reserved |
| CFP NVR 2 32989(80DDh) | 0x00 | 0 | Reserved |
| CFP NVR 2 32990(80DEh) | 0x00 | 0 | Reserved |
| CFP NVR 2 32991(80DFh) | 0x00 | 0 | Reserved |
| CFP NVR 2 32992(80E0h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32993(80E1h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32994(80E2h) | 0x00 | 0 | Reserved |
| CFP NVR 2 32995(80E3h) | 0x00 | 0 | Reserved |

| | | | | |
|---|---|---|---|---|
| CFP NVR 2 32996(80E4h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 32997(80E5h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 32998(80E6h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 32999(80E7h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33000(80E8h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33001(80E9h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33002(80EAh) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33003(80EBh) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33004(80ECh) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33005(80EDh) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33006(80EEh) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33007(80EFh) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33008(80F0h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33009(80F1h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33010(80F2h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33011(80F3h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33012(80F4h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33013(80F5h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33014(80F6h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33015(80F7h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33016(80F8h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33017(80F9h) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33018(80FAh) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33019(80FBh) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33020(80FCh) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33021(80FDh) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33022(80FEh) | 0x00 | 0 | | Reserved |
| CFP NVR 2 33023(80FFh) | 0x8E | 142 | ? | CFP NVR 2 Checksum |

## Revision History

| Revision number | Date | Description |
|---|---|---|
| 0.1 | 28/08/2015 | Preliminary |

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