

USB Power Delivery ENGINEERING CHANGE NOTICE

Title: Active Cable Status

**Applied to: USB Power Delivery Specification Revision 3.0
Version 1.1**

Brief description of the functional changes proposed:
The present Active Cable VDO is incomplete. This ECN adds additional fields to define additional capabilities and extends present ones. It also adds a Cable status to return the Active Cable's internal temperature and whether the cable is in thermal shutdown.

Benefits as a result of the proposed changes:
The workgroup defining active cables identified items in the eMarker that needed to be updated to fully support active cables.

An assessment of the impact to the existing revision and systems that currently conform to the USB specification:
As there are few if any active cables in the market that currently use the eMarker, there will be little impact.

An analysis of the hardware implications:
Minimal in the host and sink. Active cable's PD engine will require updating to handle the Status messages and thermal measurements.

An analysis of the software implications:
Impact PD firmware to read and interpret the cable's info.

An analysis of the compliance testing implications:
Active cables in general will require a new compliance program and this is just a portion of that new testing.

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Actual Change Requested

(a). Section 6.3.16, Page 112

From Text:

The *Get_Status* Message is sent by a Port to request the Port Partner's present status. The Source or Sink *Shall* respond by returning a *Status* Message (see Section 6.5.2). A Port that receives an *Alert* Message (see Section 6.4.6) indicates that the Source or Sink's Status has changed and *Should* be re-read using a *Get_Status* Message.

To Text:

The *Get_Status* Message is sent by a Port using *SOP* to request the Port Partner's present status.

The Source or Sink *Shall* respond by returning a *Status* Message (see Section 6.5.2). A Port that receives an *Alert* Message (see Section 6.4.6) indicates that the Source or Sink's Status has changed and *Should* be re-read using a *Get_Status* Message.

The *Get_Status* Message *May* also be sent to an Active Cable to get its present status using *SOP'/SOP''*.

The Active Cable *Shall* respond by returning a *Status* Message (see Section 6.5.2).

(b). Section 6.4.4.3.1.4.2, Page 139

From Text:

Active Cable VDO

An Active Cable has a USB Plug on each end at least one of which is a Cable Plug supporting SOP' Communication. An Active Cable *Shall* incorporate data bus signal conditioning circuits and *May* have a concept of Super Speed Directionality on its Super Speed wires. An Active Cable *May* include a V_{BUS} wire. An Active Cable *Shall* respond to SOP' Communication and *May* respond to SOP'' Communication. Active Cables *Shall* support the Structured VDM *Discover Identity* Command and *Shall* return the Active Cable VDO in a *Discover Identity* Command ACK as shown in Table 6-36.

Table 6-36 Active Cable VDO

USB Power Delivery ENGINEERING CHANGE NOTICE

Bit(s)	Field	Description
B31...28	HW Version	0000b...1111b assigned by the VID owner
B27...24	Firmware Version	0000b...1111b assigned by the VID owner
B23...21	VDO Version	Version Number of the VDO (not this specification Version): <ul style="list-style-type: none"> Version 1.0 = 000b Values 001b...111b are Reserved and Shall Not be used
B20	Reserved	Shall be set to zero.
B19...18	USB Type-C plug to USB Type-C/Captive	00b = Reserved, Shall Not be used 01b = Reserved, Shall Not be used 10b = USB Type-C 11b = Captive
B17	Reserved	Shall be set to zero.
B16...13	Cable Latency	0000b – Reserved, Shall Not be used 0001b – <10ns (~1m) 0010b – 10ns to 20ns (~2m) 0011b – 20ns to 30ns (~3m) 0100b – 30ns to 40ns (~4m) 0101b – 40ns to 50ns (~5m) 0110b – 50ns to 60ns (~6m) 0111b – 60ns to 70ns (~7m) 1000b – 1000ns (~100m) 1001b – 2000ns (~200m) 1010b – 3000ns (~300m) 1011b1111b Reserved, Shall Not be used Includes latency of electronics in Active Cable
B12...11	Cable Termination Type	00b...01b = Reserved, Shall Not be used 10b = One end Active, one end passive, VCONN required 11b = Both ends Active, VCONN required
B10...9	Maximum V _{BUS} Voltage	Maximum Cable V _{BUS} Voltage: 00b – 20V 01b – 30V 10b – 40V 11b – 50V
B8...7	Reserved	Shall be set to zero.
B6...5	V _{BUS} Current Handling Capability	When V _{BUS} Through Cable is “No”, Reserved, Shall Not be used. When V _{BUS} Through Cable is “Yes”: 00b = Reserved, Shall Not be used. 01b = 3A 10b = 5A 11b = Reserved, Shall Not be used.
B4	V _{BUS} Through Cable	0 = No 1 = Yes
B3	SOP” Controller Present	0 = No SOP” controller present 1 = SOP” controller present
B2...0	USB SuperSpeed Signaling Support	000b = [USB 2.0] only 001b = [USB 3.1] Gen1 010b = [USB 3.1] Gen1 and Gen2 011b...111b = Reserved, Shall Not be used

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The HW Version field (B31...28) contains a HW Version assigned by the VID owner.

The FW Version field (B27...24) contains a FW Version assigned by the VID owner.

The VDO Version field (B23...20) contains a VDO version for this VDM version number. This field indicates the expected content for this VDO.

The Connector Type field (B19...18) **shall** contain a value corresponding to the connector type on the opposite end from the USB Type-C connector.

The Cable Latency field (B16...13) **shall** contain a value corresponding to the signal latency through the cable which can be used as an approximation for its length.

The Cable Termination Type field (B12...11) **shall** contain a value corresponding to whether the Active Cable has one or two Cable Plugs requiring power from VCONN.

The Maximum V_{BUS} Voltage field (B10...9) **shall** contain the maximum voltage that **shall** be negotiated using a Fixed Supply over the cable as part of an Explicit Contract where the maximum voltage that **shall** be applied to the cable is $v_{SrcNew} \max + v_{SrcValid} \max$. For example when the Maximum V_{BUS} Voltage field is 20V, a Fixed Supply of 20V can be negotiated as part of an Explicit Contract where the absolute maximum voltage that can be applied to the cable is 21.5V.

The V_{BUS} Current Handling Capability field (B6...5) **shall** indicate whether the cable is capable of carrying 3A or 5A. The V_{BUS} Current Handling Capability **shall** only be **valid** when the V_{BUS} Through Cable field indicates an end to end V_{BUS} wire.

The V_{BUS} Through Cable field (B4) **shall** indicate whether the cable contains an end to end V_{BUS} wire.

The SOP'' Controller Present field (B3) **shall** indicate whether one of the Cable Plugs is capable of SOP'' Communication in addition to the **Normative** SOP' Communication.

The USB SuperSpeed Signaling Support field (B2...0) **shall** indicate whether the cable supports only [\[USB 2.0\]](#), or in addition Supports [\[USB 3.1\]](#) Gen1, or Gen1 and Gen2.

To Text:

Active Cable VDO

An Active Cable has a USB Plug on each end at least one of which is a Cable Plug supporting SOP' Communication. An Active Cable **shall** incorporate data bus signal conditioning circuits and **may** have a concept of Super Speed Directionality on its Super Speed wires. An Active Cable **may** include a V_{BUS} wire. An Active Cable **shall** respond to SOP' Communication and **may** respond to SOP'' Communication. Active Cables **shall** support the Structured VDM [Discover Identity](#) Command and **shall** return the Active Cable VDOs in a [Discover Identity](#) Command ACK as shown in Table 6-36 and Table TBD. The Active Cable VDO 1 is returned first followed by the Active Cable VDO 2.

Table 6-36 Active Cable VDO 1

USB Power Delivery ENGINEERING CHANGE NOTICE

Bit(s)	Field	Description
B31...28	HW Version	0000b...1111b assigned by the VID owner
B27...24	Firmware Version	0000b...1111b assigned by the VID owner
B23...21	VDO Version	Version Number of the VDO (not this specification Version): <ul style="list-style-type: none"> Version 1.1 = 001b Values 000b , 010b...111b are Reserved and Shall Not be used
B20	Reserved	Shall be set to zero.
B19...18	USB Type-C plug to USB Type-C/Captive	00b = Reserved, Shall Not be used 01b = Reserved, Shall Not be used 10b = USB Type-C 11b = Captive
B17	Reserved	Shall be set to zero.
B16...13	Cable Latency	0000b – Reserved, Shall Not be used 0001b – <10ns (~1m) 0010b – 10ns to 20ns (~2m) 0011b – 20ns to 30ns (~3m) 0100b – 30ns to 40ns (~4m) 0101b – 40ns to 50ns (~5m) 0110b – 50ns to 60ns (~6m) 0111b – 60ns to 70ns (~7m) 1000b – 1000ns (~100m) 1001b – 2000ns (~200m) 1010b – 3000ns (~300m) 1011b1111b Reserved, Shall Not be used Includes latency of electronics in Active Cable
B12...11	Cable Termination Type	00b...01b = Reserved, Shall Not be used 10b = One end Active, one end passive, VCONN required 11b = Both ends Active, VCONN required
B10...9	Maximum V _{BUS} Voltage	Maximum Cable V _{BUS} Voltage: 00b – 20V 01b – 30V 10b – 40V 11b – 50V
B8	SBU Supported	0 = SBU connections supported 1 = SBU connections are not supported
B7	SBU Type	When SBU Supported = 1 this bit shall be Ignored. When SBU Supported = 0: 0 = SBU is passive 1 = SBU is active
B6...5	V _{BUS} Current Handling Capability	When V _{BUS} Through Cable is “No”, Reserved, Shall Not be used. When V _{BUS} Through Cable is “Yes”: 00b = Reserved, Shall Not be used. 01b = 3A 10b = 5A 11b = Reserved, Shall Not be used.
B4	V _{BUS} Through Cable	0 = No 1 = Yes
B3	SOP” Controller Present	0 = No SOP” controller present 1 = SOP” controller present

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Bit(s)	Field	Description
B2...0	Reserved	Shall be set to zero.

The HW Version field (B31...28) contains a HW Version assigned by the VID owner.

The FW Version field (B27...24) contains a FW Version assigned by the VID owner.

The VDO Version field (B23...20) contains a VDO version for this VDM version number. This field indicates the expected content for this VDO.

The Connector Type field (B19...18) **Shall** contain a value corresponding to the connector type on the opposite end from the USB Type-C connector.

The Cable Latency field (B16...13) **Shall** contain a value corresponding to the signal latency through the cable which can be used as an approximation for its length.

The Cable Termination Type field (B12...11) **Shall** contain a value corresponding to whether the Active Cable has one or two Cable Plugs requiring power from VCONN.

The Maximum V_{BUS} Voltage field (B10...9) **Shall** contain the maximum voltage that **Shall** be negotiated using a Fixed Supply over the cable as part of an Explicit Contract where the maximum voltage that **Shall** be applied to the cable is v_{SrcNew} max + $v_{SrcValid}$ max. For example when the Maximum V_{BUS} Voltage field is 20V, a Fixed Supply of 20V can be negotiated as part of an Explicit Contract where the absolute maximum voltage that can be applied to the cable is 21.5V.

The SBU Supported field (B8) **Shall** indicate whether the cable supports the SBUs in the cable.

The SBU Type field (B7) **Shall** indicate whether the SBUs are passive or active (e.g. digital).

The V_{BUS} Current Handling Capability field (B6...5) **Shall** indicate whether the cable is capable of carrying 3A or 5A. The V_{BUS} Current Handling Capability **Shall** only be **Valid** when the V_{BUS} Through Cable field indicates an end to end V_{BUS} wire.

The V_{BUS} Through Cable field (B4) **Shall** indicate whether the cable contains an end to end V_{BUS} wire.

The SOP'' Controller Present field (B3) **Shall** indicate whether one of the Cable Plugs is capable of SOP'' Communication in addition to the **Normative** SOP' Communication.

~~The USB SuperSpeed Signaling Support field (B2...0) **Shall** indicate whether the cable supports only **[USB 2.0]**, or in addition Supports **[USB 3.1]** Gen1, or Gen1 and Gen2.~~

Table 6-36 Active Cable VDO 2

USB Power Delivery ENGINEERING CHANGE NOTICE

Bit(s)	Field	Description
B31...24	Maximum Operating Temperature	The maximum internal operating temperature. It may or may not reflect the plug's skin temperature.
B23...16	Shutdown Temperature	The temperature at which the cable will go into thermal shutdown so as not to exceed the allowable plug skin temperature.
B15...6	Reserved	Reserved, Shall Not be used.
B5	USB 2.0 Supported	0 = [USB 2.0] supported 1 = [USB 2.0] not supported
B4	SuperSpeed Supported	0 = [USB 3.1] SuperSpeed supported 1 = [USB 3.1] SuperSpeed not supported
B3	SuperSpeed Lanes Supported	0 = One Lane 1 = Two Lanes
B2	Reserved	Reserved, Shall Not be used.
B1...0	SuperSpeed Signaling	00b Gen 1 01b Gen 2 10 - 11b = Reserved, Shall Not be used

Maximum Operating Temperature field (B31...24) **Shall** report the maximum allowable operating temperature inside the plug.

Shutdown Temperature field (B23...16) **Shall** indicate the temperature inside the plug at which the plug will shutdown its active signaling components. When this temperature is reached, it will be reported in the Active Cable Status Message by the Thermal Shutdown bit.

The USB 2.0 Supported field (B15) **Shall** indicate whether or not the cable supports USB 2.0 signaling.

The USB SuperSpeed Supported field (B4) **Shall** indicate whether or not the cable supports SuperSpeed signaling.

The USB SuperSpeed Lanes Supported field (B3) **Shall** indicate whether the cable supports one or two lanes of SuperSpeed signaling.

The USB SuperSpeed Signaling field (B1...0) **Shall** indicate whether the cable supports Gen1 or Gen 2 SuperSpeed signaling.

(c). Section 6.5.2, Page 160

From Text:

6.5.2 Status Message

The **Status** Message **Shall** be sent in response to a **Get_Status** Message. The **Status** Message enables a Port to inform its Port Partner about the present status of the Source or Sink. Typically a **Get_Status** Message will be sent by the Port after receipt of an **Alert** Message. Some of the reported events are critical such as OCP, OVP and OTP, while others are informative such as change in a Battery's status from charging to neither charging nor discharging. The **Status** Message returns a 5-byte Status Data Block (SDB) whose format **Shall** be as shown in Figure 6-31 and Table 6-44.

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Figure 6-31 Status Message

Extended Header	SDB
Data Size = 2	(2-byte block)

Table 6-44 Status Data Block (SDB)

Offset (Byte)	Field	Size	Value	Description														
0	Internal Temp	1	Numeric	Source or Sink's internal temperature in degrees centigrade. 0 = feature not supported 1 = temperature is less than 2°C. 2-255 = temperature in °C.														
1	Present Input	1	Bit field	<table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td>Reserved and Shall be set to zero</td></tr><tr><td>1</td><td>External Power when set</td></tr><tr><td>2</td><td>External Power AC/DC (Valid when Bit 1 set) 0: DC 1: AC Reserved when Bit 1 is zero</td></tr><tr><td>3</td><td>Internal Power from Battery when set</td></tr><tr><td>4</td><td>Internal Power from non-Battery power source when set</td></tr><tr><td>5...7</td><td>Reserved and Shall be set to zero</td></tr></table>	Bit	Description	0	Reserved and Shall be set to zero	1	External Power when set	2	External Power AC/DC (Valid when Bit 1 set) 0: DC 1: AC Reserved when Bit 1 is zero	3	Internal Power from Battery when set	4	Internal Power from non-Battery power source when set	5...7	Reserved and Shall be set to zero
Bit	Description																	
0	Reserved and Shall be set to zero																	
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2	External Power AC/DC (Valid when Bit 1 set) 0: DC 1: AC Reserved when Bit 1 is zero																	
3	Internal Power from Battery when set																	
4	Internal Power from non-Battery power source when set																	
5...7	Reserved and Shall be set to zero																	
2	Present Battery Input	1	Bit field	When Present Input field bit 3 set Shall contain the bit corresponding to the Battery or Batteries providing power: Upper nibble = Hot Swappable Battery (b7...4) Lower nibble = Fixed Battery (b3...0) When Present Source Input field bit 3 is not set this field is Reserved and Shall be set to zero.														
3	Event Flags	1	Bit field	<table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td>Reserved and Shall be set to zero</td></tr><tr><td>1</td><td>OCP event when set</td></tr><tr><td>2</td><td>OTP event when set</td></tr><tr><td>3</td><td>OVP event when set (Sink only, for Source Reserved and Shall be set to zero)</td></tr><tr><td>4</td><td>CF mode when set, CV mode when cleared</td></tr><tr><td>5...7</td><td>Reserved and Shall be set to zero</td></tr></table>	Bit	Description	0	Reserved and Shall be set to zero	1	OCP event when set	2	OTP event when set	3	OVP event when set (Sink only, for Source Reserved and Shall be set to zero)	4	CF mode when set, CV mode when cleared	5...7	Reserved and Shall be set to zero
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4	CF mode when set, CV mode when cleared																	
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4	Temperature Status	1	Bit field	<table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td>Reserved and Shall be set to zero</td></tr><tr><td>1...2</td><td>00 – Not Supported 01 – Normal 10 – Warning 11 – Over temperature</td></tr><tr><td>3...7</td><td>Reserved and Shall be set to zero</td></tr></table>	Bit	Description	0	Reserved and Shall be set to zero	1...2	00 – Not Supported 01 – Normal 10 – Warning 11 – Over temperature	3...7	Reserved and Shall be set to zero						
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1...2	00 – Not Supported 01 – Normal 10 – Warning 11 – Over temperature																	
3...7	Reserved and Shall be set to zero																	

6.5.2.1 Internal Temp

The Internal Temp field reports the instantaneous temperature of a portion of the Source or Sink.

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6.5.2.2 Present Input

The Present Input field indicates which supplies are presently powering the Source or Sink.

The following bits are defined:

- Bit 1 indicates that an external Source is present.
- Bit 2 indicates whether the external unconstrained Source is AC or DC.
- Bit 3 indicates that power is being provided from Battery.
- Bit4 indicates an alternative internal source of power that is not a Battery.

6.5.2.3 Present Battery Input

The Present Battery Input field indicates which Battery or Batteries are presently supplying power to the Source or Sink. The Present Battery Input field is only **Valid** when the Present Input field indicates that there is Internal Power from Battery.

The upper nibble of the field indicates which Hot Swappable Battery/Batteries are supplying power with bit 4 in upper nibble corresponding to Battery 4 and bit 7 in the upper nibble corresponding to Battery 7 (see Section 6.5.3 and Section 6.5.4).

The lower nibble of the field indicates which Fixed Battery/Batteries are supplying power with bit 0 in lower nibble corresponding to Battery 0 and bit 3 in the lower nibble corresponding to Battery 3 (see Section 6.5.3 and Section 6.5.4).

6.5.2.4 Event Flags Field

The Event Flags field returns event flags. The OTP, OVP and OCP event flags **Shall** be set when there is an event and **Shall** only be cleared when read with the **Get_PPS_Status** Message.

When the OTP event flag is set the Temperature Status field **Shall** also be set to over temperature.

The CF/CV mode bit is only **Valid** when operating as a Programmable Power Supply and **Shall** be **Ignored** otherwise. When the Source is operating as a Programmable Power Supply the CF/CV mode bit **Shall** be set when operating in Current Foldback mode (CF mode) and **Shall** be cleared when operating in Constant Voltage mode (CV mode).

6.5.2.5 Temperature Status

The Temperature Status field returns the current temperature status of the device either: normal, warning and over temperature. When the Temperature Status field is set to over temperature the OTP event flag **Shall** also be set.

To Text:

6.5.2 Status Message

The **Status** Message **Shall** be sent in response to a **Get_Status** Message. The contents of the **Status** Message depends on the target of the **Get_Status** Message. When sent to SOP the **Status** Message returns the status of the Port's Port Partner. When sent to SOP' or SOP'' the **Status** Message returns the status of the Active Cable's plug.

6.5.2.1 SOP Status Message

The **Status** Message in response to a **Get_Status** Message sent to SOP enables a Port to inform its Port Partner about the present status of the Source or Sink. Typically a **Get_Status** Message will be sent by the Port after receipt of an **Alert** Message. Some of the reported events are critical such as OCP, OVP and OTP, while others are informative such as change in a Battery's status from charging to neither charging nor discharging.

The **Status** Message returns a 5-byte Status Data Block (SDB) whose format **Shall** be as shown in Figure 6-31 and Table 6-44.

Figure 6-31 SOP Status Message

Extended Header	SDB
Data Size = 5	(5-byte block)

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Table 6-44 SOP Status Data Block (SDB)

Offset (Byte)	Field	Size	Value	Description														
0	Internal Temp	1	Numeric	Source or Sink's internal temperature in degrees centigrade. 0 = feature not supported 1 = temperature is less than 2°C. 2-255 = temperature in °C.														
1	Present Input	1	Bit field	<table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td>Reserved and Shall be set to zero</td></tr><tr><td>1</td><td>External Power when set</td></tr><tr><td>2</td><td>External Power AC/DC (Valid when Bit 1 set) 0: DC 1: AC Reserved when Bit 1 is zero</td></tr><tr><td>3</td><td>Internal Power from Battery when set</td></tr><tr><td>4</td><td>Internal Power from non-Battery power source when set</td></tr><tr><td>5...7</td><td>Reserved and Shall be set to zero</td></tr></table>	Bit	Description	0	Reserved and Shall be set to zero	1	External Power when set	2	External Power AC/DC (Valid when Bit 1 set) 0: DC 1: AC Reserved when Bit 1 is zero	3	Internal Power from Battery when set	4	Internal Power from non-Battery power source when set	5...7	Reserved and Shall be set to zero
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5...7	Reserved and Shall be set to zero																	
2	Present Battery Input	1	Bit field	When Present Input field bit 3 set Shall contain the bit corresponding to the Battery or Batteries providing power: Upper nibble = Hot Swappable Battery (b7...4) Lower nibble = Fixed Battery (b3...0) When Present Source Input field bit 3 is not set this field is Reserved and Shall be set to zero.														
3	Event Flags	1	Bit field	<table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td>Reserved and Shall be set to zero</td></tr><tr><td>1</td><td>OCP event when set</td></tr><tr><td>2</td><td>OTP event when set</td></tr><tr><td>3</td><td>OVP event when set (Sink only, for Source Reserved and Shall be set to zero)</td></tr><tr><td>4</td><td>CF mode when set, CV mode when cleared</td></tr><tr><td>5...7</td><td>Reserved and Shall be set to zero</td></tr></table>	Bit	Description	0	Reserved and Shall be set to zero	1	OCP event when set	2	OTP event when set	3	OVP event when set (Sink only, for Source Reserved and Shall be set to zero)	4	CF mode when set, CV mode when cleared	5...7	Reserved and Shall be set to zero
Bit	Description																	
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4	Temperature Status	1	Bit field	<table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td>Reserved and Shall be set to zero</td></tr><tr><td>1...2</td><td>00 – Not Supported 01 – Normal 10 – Warning 11 – Over temperature</td></tr><tr><td>3...7</td><td>Reserved and Shall be set to zero</td></tr></table>	Bit	Description	0	Reserved and Shall be set to zero	1...2	00 – Not Supported 01 – Normal 10 – Warning 11 – Over temperature	3...7	Reserved and Shall be set to zero						
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1...2	00 – Not Supported 01 – Normal 10 – Warning 11 – Over temperature																	
3...7	Reserved and Shall be set to zero																	

6.5.2.1.1 Internal Temp

The Internal Temp field reports the instantaneous temperature in degrees centigrade of a portion of the Source or Sink.

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6.5.2.1.2 Present Input

The Present Input field indicates which supplies are presently powering the Source or Sink.

The following bits are defined:

- Bit 1 indicates that an external Source is present.
- Bit 2 indicates whether the external unconstrained Source is AC or DC.
- Bit 3 indicates that power is being provided from Battery.
- Bit4 indicates an alternative internal source of power that is not a Battery.

6.5.2.1.3 Present Battery Input

The Present Battery Input field indicates which Battery or Batteries are presently supplying power to the Source or Sink. The Present Battery Input field is only **Valid** when the Present Input field indicates that there is Internal Power from Battery.

The upper nibble of the field indicates which Hot Swappable Battery/Batteries are supplying power with bit 4 in upper nibble corresponding to Battery 4 and bit 7 in the upper nibble corresponding to Battery 7 (see Section 6.5.3 and Section 6.5.4).

The lower nibble of the field indicates which Fixed Battery/Batteries are supplying power with bit 0 in lower nibble corresponding to Battery 0 and bit 3 in the lower nibble corresponding to Battery 3 (see Section 6.5.3 and Section 6.5.4).

6.5.2.1.4 Event Flags Field

The Event Flags field returns event flags. The OTP, OVP and OCP event flags **Shall** be set when there is an event and **Shall** only be cleared when read with the **Get_PPS_Status** Message.

When the OTP event flag is set the Temperature Status field **Shall** also be set to over temperature.

The CF/CV mode bit is only **Valid** when operating as a Programmable Power Supply and **Shall** be **Ignored** otherwise. When the Source is operating as a Programmable Power Supply the CF/CV mode bit **Shall** be set when operating in Current Foldback mode (CF mode) and **Shall** be cleared when operating in Constant Voltage mode (CV mode).

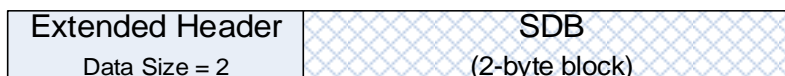
6.5.2.1.5 Temperature Status

The Temperature Status field returns the current temperature status of the device either: normal, warning or over temperature. When the Temperature Status field is set to over temperature, the OTP event flag **Shall** also be set.

6.5.2.2 SOP'/SOP'' Status Message

The **Status** Message in response to a **Get_Status** Message sent to SOP' or SOP'' enables a Source or Sink to get the present status of the Active Cable's plug(s). Typically a **Get_Status** Message will be used by the host and/or device to manage the Active Cable's plug temperature. The **Status** Message returns a 2-byte Status Data Block (SDB) whose format **Shall** be as shown in Figure 6-31 and Table 6-44.

Figure 6-31 SOP' Status Message



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Table 6-44 SOP' Status Data Block (SDB)

Offset (Byte)	Field	Value	Description						
0	Internal Temp	Unsigned Int	Active Cable plug's internal temperature in °C. 0 = feature not supported 1 = temperature is less than 2°C. 2-255 = temperature in °C.						
1	Flags	Bit field	<table><tr><th>Bit</th><th>Description</th></tr><tr><td>0</td><td>Thermal Shutdown</td></tr><tr><td>1...7</td><td>Reserved and Shall be set to zero</td></tr></table>	Bit	Description	0	Thermal Shutdown	1...7	Reserved and Shall be set to zero
Bit	Description								
0	Thermal Shutdown								
1...7	Reserved and Shall be set to zero								

6.5.2.2.1 Internal Temp

The Internal Temp field reports the instantaneous temperature of the plug in °C. The internal temperature shall be monotonic. The Active Cable shall update its Internal Temperature at least every 500 ms.

6.5.2.2.2 Thermal Shutdown

The Thermal Shutdown flag **Shall** also be set when the plug's internal temperature exceeds the Internal Maximum Temperature reported in the Active Cable VDO. Once this bit has been set, it **Shall** remain set and the plug **Shall** remain in Thermal Shutdown until there is a Hard Reset or the Active Cable's power is removed. The Thermal Shutdown flag **Shall Not** be cleared by a Cable Reset.