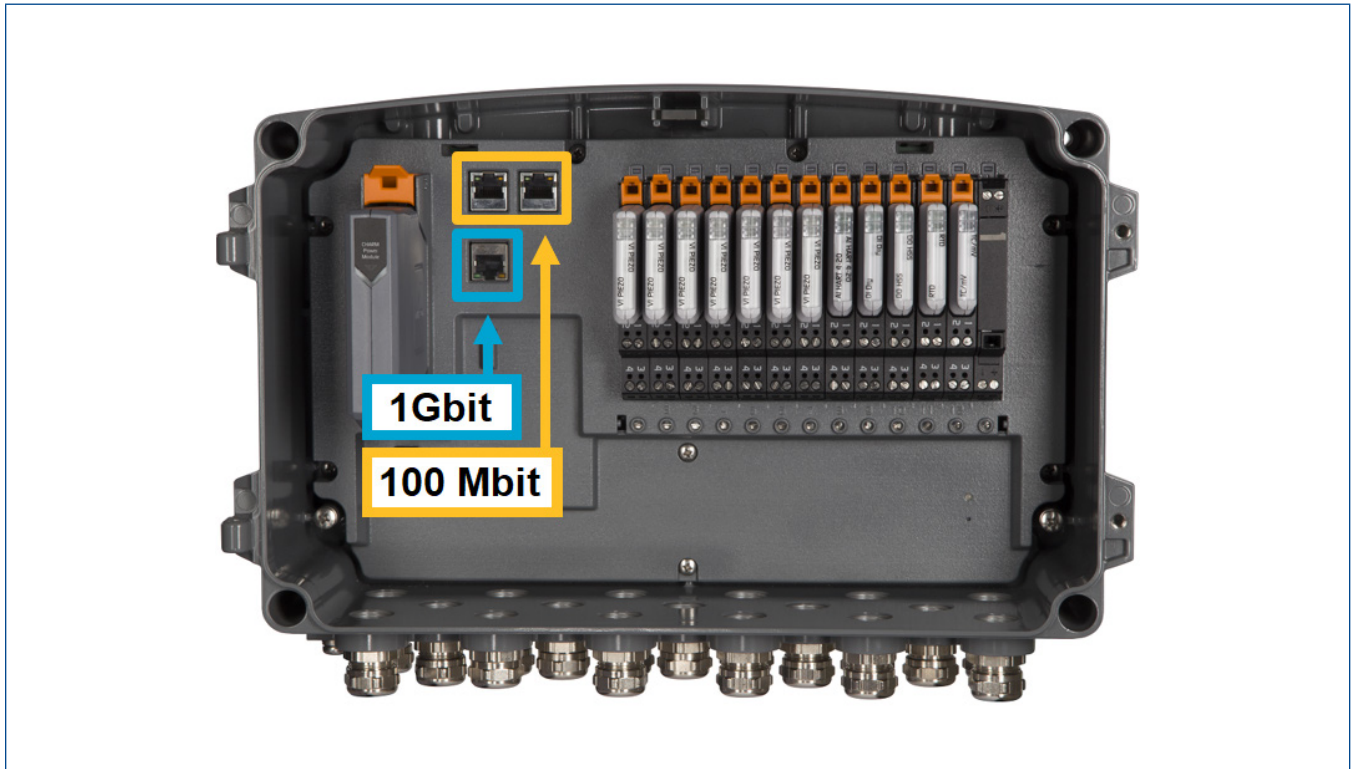


Daisy Chaining AMS Asset Monitor(s)



Since release of the AMS Asset Monitor (further in this document just called AM), we often get asked what daisy chaining means and how the wording needs to be interpreted when being used. This Whitepaper should help in understanding the wording in general and how it can be managed with AM where needed.

Before talking about daisy chaining AM boxes, please be informed that the AM is equipped with three LAN ports where the upper two 100Mbit ports are switched within AM thus physically they can be expected to be one interface with one IP address but having two ports available within AM for allowing chain network topology without external HW switch requirements.

The lower 1Gbit port is separated from those two thus the upper ports and lower port allow access to the AM from different networks and different IPs.

For chain network topology builds we expect only the upper 100Mbit ports being used and finally connecting the first or last device (from whatever direction you look to this) being connected to the network using the 100Mbit port as well thus those are the ports to be used for daisy chaining, where the lower (1Gbit) port could be used for single point access or start topology networks.

The diagram illustrates the physical and logical configuration of two AMS Asset Monitor boxes. At the top, two physical units are shown. The left unit has a red arrow pointing to its LAN1 port labeled "to Network". The right unit has a red arrow pointing to its LAN2 port labeled "to further AMs (if applicable)". Both units have a red box around the "Address Plug No. 1" on the LAN1 port.

Below the physical units are two configuration screenshots. "Box 1" shows the "Network IPv4" configuration for LAN1 with IP address 192.168.2.100 and LAN2 with IP address 192.168.2.101. A red arrow labeled "Unique IP" points to the LAN2 IP address. "Box 2" shows the "Network IPv4" configuration for LAN1 with IP address 192.168.2.101 and LAN2 with IP address 192.168.2.1. A red arrow labeled "Unique IP" points to the LAN2 IP address.

At the bottom are two dashboard screenshots. "Dashboard: Box 1 (IP 192.168.2.100)" and "Dashboard: Box 2 (IP 192.168.2.101)" both show identical asset status metrics: 1 Total Asset, 12 Total CHARMs, and Device status (IP address, Time, User connected, Air temperature, Main voltage). Both dashboards also feature an "Overall assets health trend" chart.

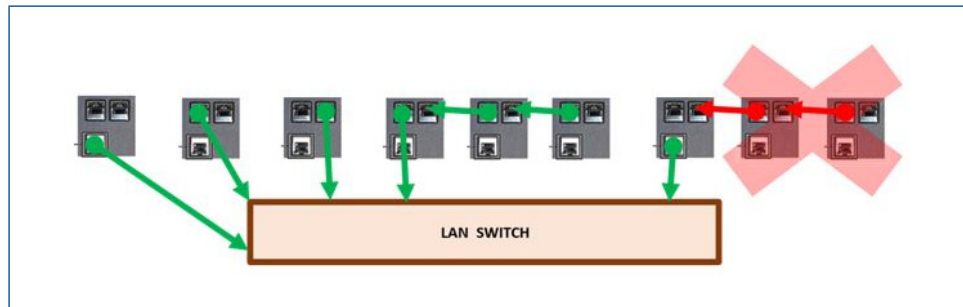
NOTE: IPs are just examples to show that each box needs a unique one.

Referring to the Address plug, please keep in mind that it **must** be “No 1” type for all AMs we use today. Spoken from history, it was foreseen to vary in the future (range 1 ... 8) where up to 8 AMs start exchanging data for being used within an Asset at one AM but measured from another AM box. Clearly saying that this is not available today and not foreseen to be added to the AMS Asset Monitor performance short term. Resulting from this, daisy chaining is meant for the network connections only but there is no data interaction between the AM boxes within the chain.

With keeping this information in mind but now focusing on its functionality in terms of building flexible LAN architectures it means that every unit needs to have a unique IP address configured manually since daisy chained units will not be able to get IP addresses from a DHCP server. Further to this, the LAN2 (double-port, 100 Mbit interface) must be used for chain network topologies.

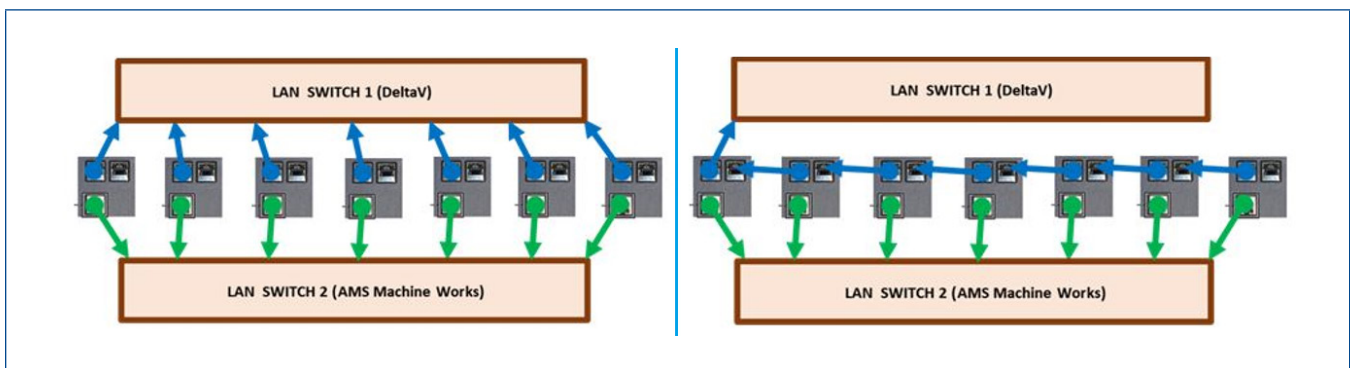
Daisy Chaining AMS Asset Monitor(s)

There is no difficulty in making AMs networking but keep in mind that LAN1 (1 Gbit) and LAN2 (100 Mbit) of Asset Monitor are separated (not linked to each other). You cannot daisy chain multiple units to each other using LAN2 but trying to access the network by connection one of those AMs using LAN1 (as shown from the red cross on picture below which marks the AMs disconnected to the network).



Generally spoken LAN1 and LAN2 are the equivalent interfaces of the AMS Asset Monitor where configuration and the GUI (Graphical User Interface) as well as all data is made available on both with only difference that LAN1 is faster (1Gbit) but LAN2 (100 Mbit) allows access from two ports with an internal hub. LAN1 and LAN2 are not routed within the AM internally.

This allows to use LAN1 and LAN2 in two different and separated networks. We clearly recommend to never use both LAN interfaces of one unit within one single network. Where applicable, use LAN1 in star architecture exclusively since LAN2 is the only one supporting daisy chain connection (but it can be used in star and mixed architecture as well). From picture below you can see that different AMs in the same network can use different LAN ports, as required where a mix of star and daisy chain architecture is also possible.



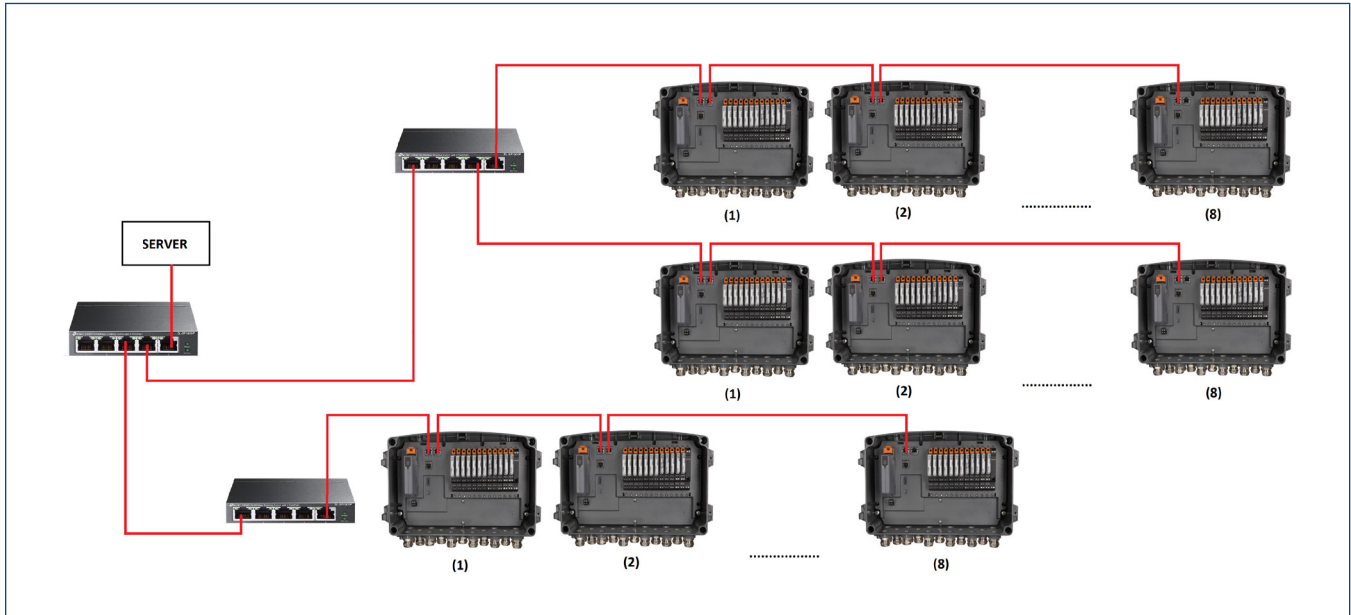
NOTE: Network nomenclature (DeltaV / AMS Machine Works) are just examples.

As you know, every Asset Monitor provides a network hub / switch (LAN2), but the recommended maximum number of daisy chained Asset Monitors is 8 per line for reduction of single point of failure impacts to the communication to all AMs. A larger number than 8 daisy chained units was not tested yet.

With multiple unit's being daisy chained, the communication via multiple switches (unit-switch-unit-switch-unit-switch...) will introduce a significant latency in the communication. The communication with the last units in the chain will be slower but for sure all AM interfaces (including GUI) still do respond.

Daisy Chaining AMS Asset Monitor(s)

It's always possible to mix the daisy chain with star architecture and to have the switches concentrating the network traffic from multiple units at some point. This does help to mitigate the possible latency issue where the cost of the switches and cabling is typically not very significant from overall project scope.



The picture above shows an example for a typical network structure with up to 8 AMS (max.) being daisy chained but multiple chain lines build and connected to various switches within the network.

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