Serial Communications Applications

Control and Recording Products Supporting RS485 Modbus RTU Protocol
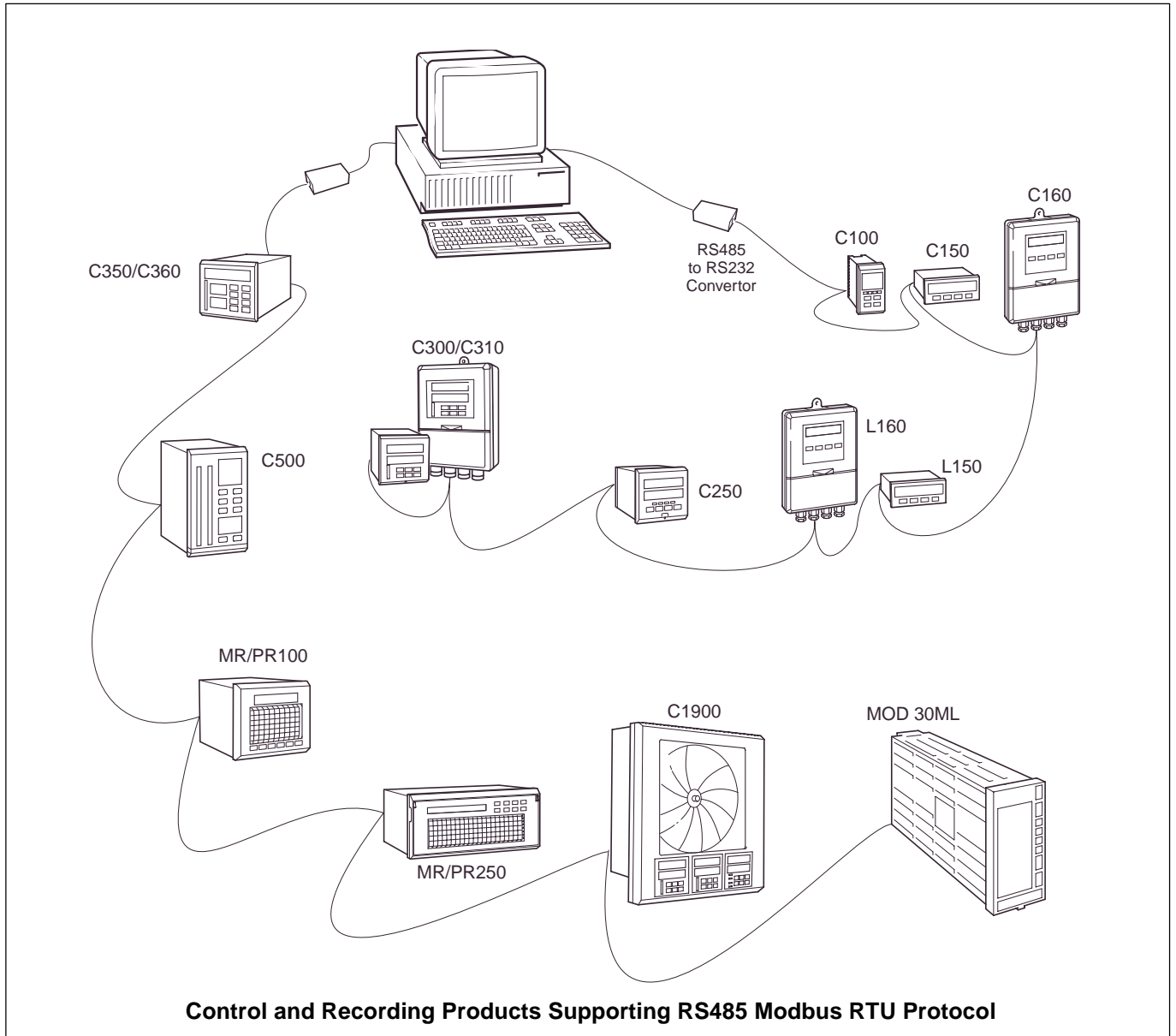
The following pages outline some examples of the types of applications on which Modbus Serial Communications can be most effectively used.

Management Information Systems

Modbus serial links enable recording of data from controllers and recorders located in the field. Back at a central point the trended data can be used for management overview or archived for later use.

Quick and Easy Process Changes

Modbus can also be used to change the settings in controllers, i.e. set point, range etc. making process mode and output changes quick and simple.

Simple Upgrades

Modbus serial communications are available as a factory-fitted or field-upgradable option on all COMMANDER, DATUM and Advanced Control products shown above.

ABB Instrumentation

Typical Customer Questions

Q: **What is the difference between a Serial Interface and Protocol when it comes to Serial Communications?**

A: The Serial Interface is the hardware or 'voice', Protocol is the software or the language you are speaking over the interface.

Q: **What type of serial interfaces do you support in the COMMANDER Range?**

A: It is dependent on the product. However, we mostly support RS422 and RS485.

Q. **What about MOD 30ML and MODCELL?**

A: MOD 30ML and MODCELL support both RS232 and RS485.

Q: **What Protocol do you talk over this Serial Interface?**

A: Modbus RTU.

Q: **What SCADA Packages support Modbus?**

A: Most SCADA packages support Modbus. However, you should check with your SCADA supplier. The Modbus Protocol was released by Modicon (now AEG) many years ago and has since become a defacto world standard – it is rare to find a SCADA package, PLC or other master device that does not support it.

Q: **Can you communicate on Modbus Plus?**

A: Modbus protocols include Modbus Plus, Modbus ASCII and Modbus RTU. Our instruments cannot communicate directly over Modbus Plus. Gateways are available from Modicon and others to enable Modbus RTU data to be made available on Modbus Plus. However, these do not provide higher speed communications because you are still using standard Modbus RTU on one side of the gateway. They are simply a means of putting data on the Modbus Plus highway.

Q: **What is the difference between the Modbus protocols?**

A: Modbus ASCII is a fairly old, quite slow protocol that was implemented in early serial devices. Modbus Plus is a peer-to-peer, high-speed protocol which is licensed and controlled by AEG. Modbus RTU is Master/Slave and is not licensed; in fact AEG distributes the specification freely. Therefore most packages and devices implement Modbus RTU as it is cheaper and provides a wider range of connectivity.

Q: **Can Modbus operate over a Modem or a Radio?**

A: Yes, with the right modem. Not all PC drivers support modem communications. Also, in some applications the user expects the remote site to be idle until a change occurs. Our instruments do not support this 'report by exception', so a smart modem must be used which can be triggered by a digital signal from the instrument.

Q: **Can COMMANDER Products and MOD 30ML communicate on Ethernet or Arcnet?**

A: There is not a direct interface to these networks. If you require this sort of networking it can only be done at PC Level.

...Typical Customer Questions

Q: How many Slaves can we have on RS232, RS422 and RS485 Networks?

A: RS232 is a point-to-point network, it only allows communications between two devices. For example, you could have one controller and one PC, or one MOD 30ML and one recorder.

RS485 allows 32 nodes on a network and RS422 allows 10 nodes, one of which must be the Master. In most cases the master is a PC, but it could be a PLC or a MOD 30ML. This can be extended, but you need a repeater station.

Network and electrical loading is of prime consideration to the user. We do not recommend more than eight or ten instruments on a single Modbus network for performance reasons.

Q: What are Slaves and Nodes

A: A slave is the instrument being talked to by the master (typically a PC). A node is any device on the serial link, whether master or slave.

Q: Is Modbus a Peer to Peer Network?

A: No, Modbus is a Master/Slave protocol. The Master (in most cases, a PC) requests data from each of the Slaves in turn. Modbus as a protocol allows for one master and up to 247 slaves per network. However, this number is affected by the serial interface, whether it is RS485 or RS422, and desired performance requirements.

Q: What is the difference between Master and Slave?

A: The Master initiates all transactions with the Slave units.

Q: Can COMMANDER or DATUM Products be a Master?

A: No. COMMANDER and DATUM instruments can only be Slaves on the network. However, products such as the MOD30ML and MODCELL can be a Master or Slave, or optionally, both at once.

Q: What is the maximum distance we can run an RS232 or RS485 Network?

A:

RS232	Up to 15m (50ft)	Virtually any standard shielded twisted pair with drain. (Belden 9502 or equivalent)
RS422 and RS485	Up to 6m (20ft)	Virtually any standard shielded twisted pair
	Up to 300m (1000ft)	24 AWG twisted pair with overall foil shield and drain wire (Belden 9841 for 2-wire and 9502 for 4-wire or equivalent)
	Up to 1.2km (4000ft)	24 AWG twisted pair with foil shield and drain wire on each pair (Belden 9841 for 2-wire and 9729 for 4-wire or equivalent)

Q: What are Half Duplex and Full Duplex Systems?

A: Half Duplex is a 2-wire system where as Full Duplex is typically a 4-wire system. On full-duplex systems, both devices can transmit and receive at the same time. On a half-duplex, only one device can transmit (or receive) at a time. Modbus is actually a half-duplex protocol regardless of hardware, but more drivers and devices support full-duplex hardware than half-duplex. Therefore, most of them use the 4-wire system.

...Typical Customer Questions

Q: What is the difference between 2-wire and 4-wire?

A: Besides the fact that one uses fewer wires there are a few other differences:

The software driver in the PC must support 2-wire communications, so that when the PC is not transmitting it maintains the line in a certain state so the master device can transmit. Most software packages cannot do this and only support 4-wire configuration.

Also, in a 4-wire system, slave transmissions are 'heard' only by the Master. In a 2-wire system, Slave transmissions are 'heard' and must be interpreted by every unit on the link. This means a Slave on a 2-wire system must be smart enough to ignore its own messages.

Q: I understand Modbus registers and their type can be identified by their numbers. Is this true?

A: Yes. The register numbers of a Modbus node identify if it is a Bit (discrete) or Word (count, 16 bit positive value) and whether these allow 'read only' or 'read and write' access.

One Word, or a value such as the controller set point, occupies one holding register. The typical groupings of registers in Modbus are:

0XXXX	Coils and Discrete Outputs
1XXXX	Discrete Inputs (read only)
30XXX	Read Only Single Registers
31XXX	Read Only Multiple Registers
40XXX	Read/Write Single Registers
41XXX	Read/Write Multiple Registers

Q: How do I change a value, such as the controller set point, from the SCADA package?

A: First, use the Serial Communications Supplement supplied with the product manual to identify the register(s) you wish to address. With MOD 30ML or MODCELL, these registers are defined at configuration time. After this it depends on the SCADA package you are using, but basically you need to create a tag on the system along with the associated data required for that tag.

> ✱   **Note.** The set point (and other parameters) must be in read/write registers if you want to change them from the PC.

Glass Tank Control

▶ COMMANDER 300 or 350 Controller – independent forehearth or feeder control. This example uses 3 per forehearth, connected to the SCADA system via an RS485 link.

▶ MODCELL – glass furnace control, including Fuel/Air ratio, control feedback, sequencing and safety shutdown. The MODCELL is also connected directly to an operator interface station.


Glass Containers and Parts Manufacture
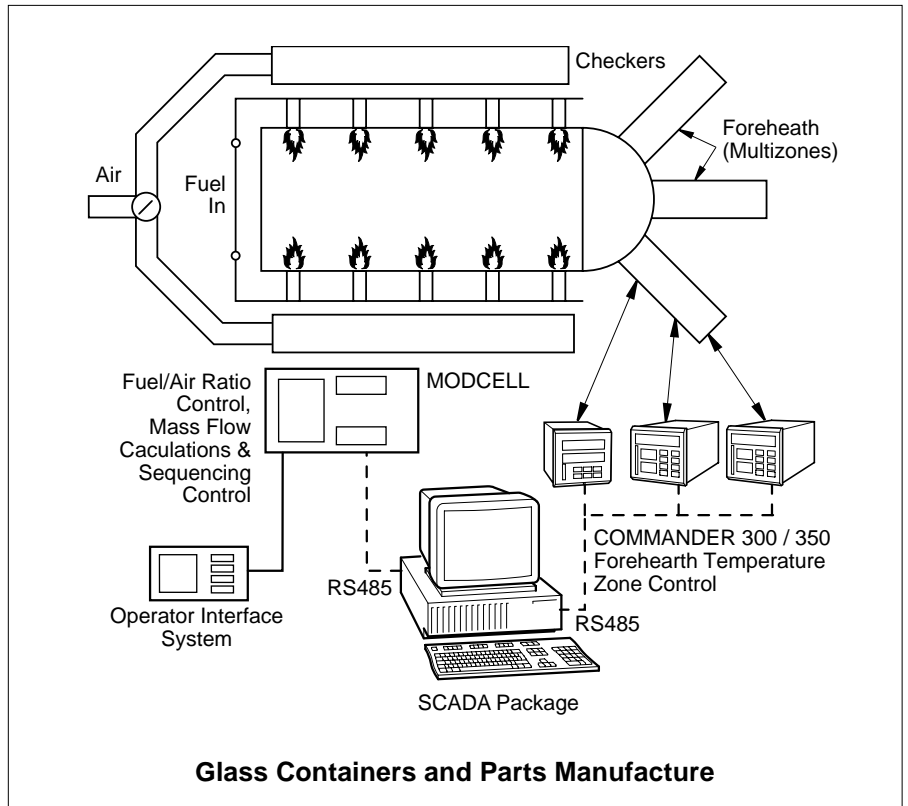
Environmentally Controlled Atmosphere Rooms

▶ Environmental control and data acquisition from multiple storage rooms or clean air rooms in manufacturing facilities.

▶ COMMANDER100 – temperature control

▶ MOD 30ML – temperature control of multiple zones in one controller

▶ COMMANDER PR250 – temperature recording. Three temperatures per room, eight rooms per recorder. Additional recorders can be multi-dropped on an RS485 network.
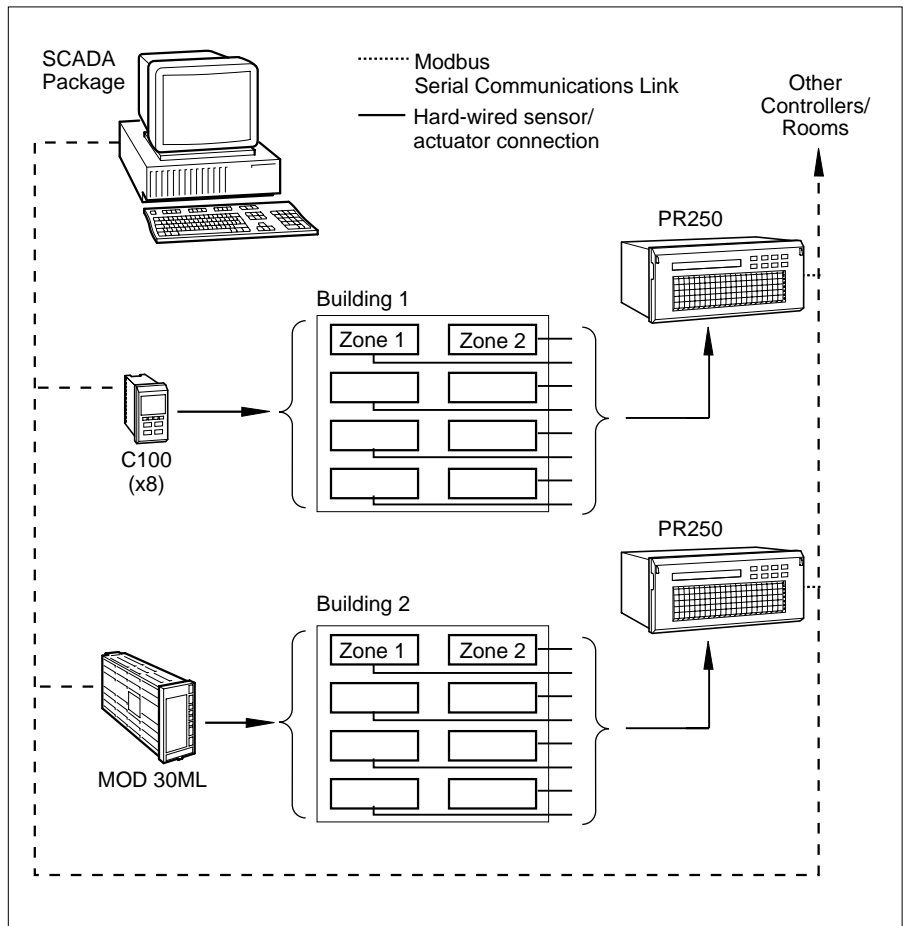
Multiple Zone Furnaces, Ovens, Kilns

▶ COMMANDER 350 – used for temperature control of furnaces by controlling fuel rate to the burners.

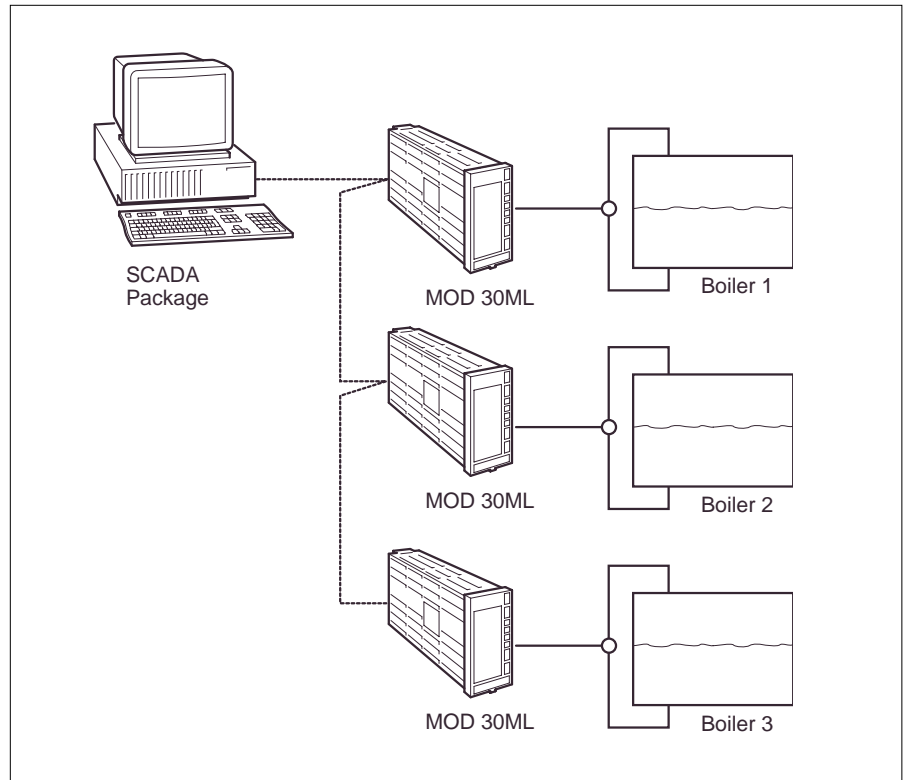▶ Controllers can be linked via an RS485 network to a SCADA package for furnace temperature trending.
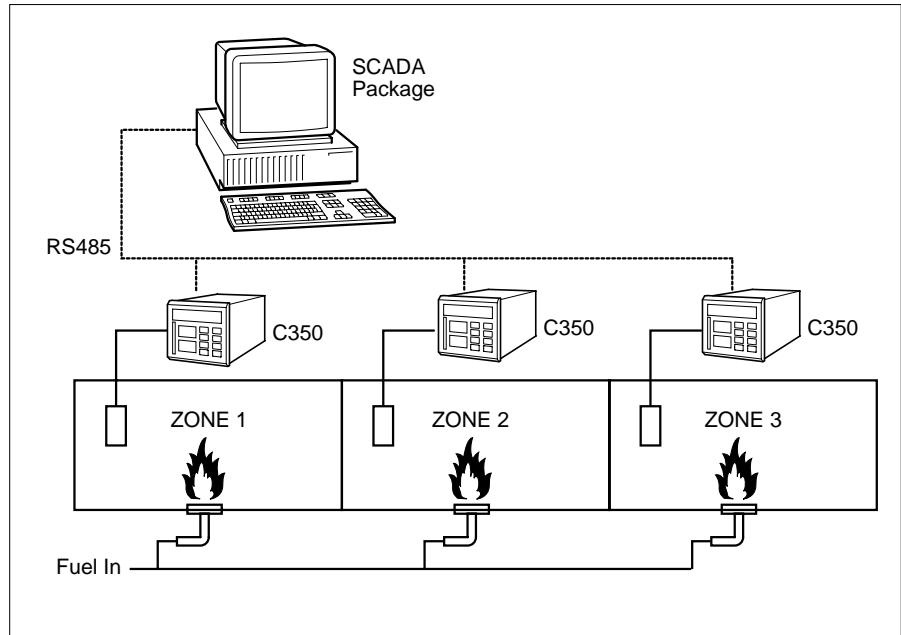
Tunnel Kiln Control

▶ COMMANDER V250 – sequencing motorized valves in gas-fired tunnel kilns used for the firing of bricks, tiles and other ceramic ware.
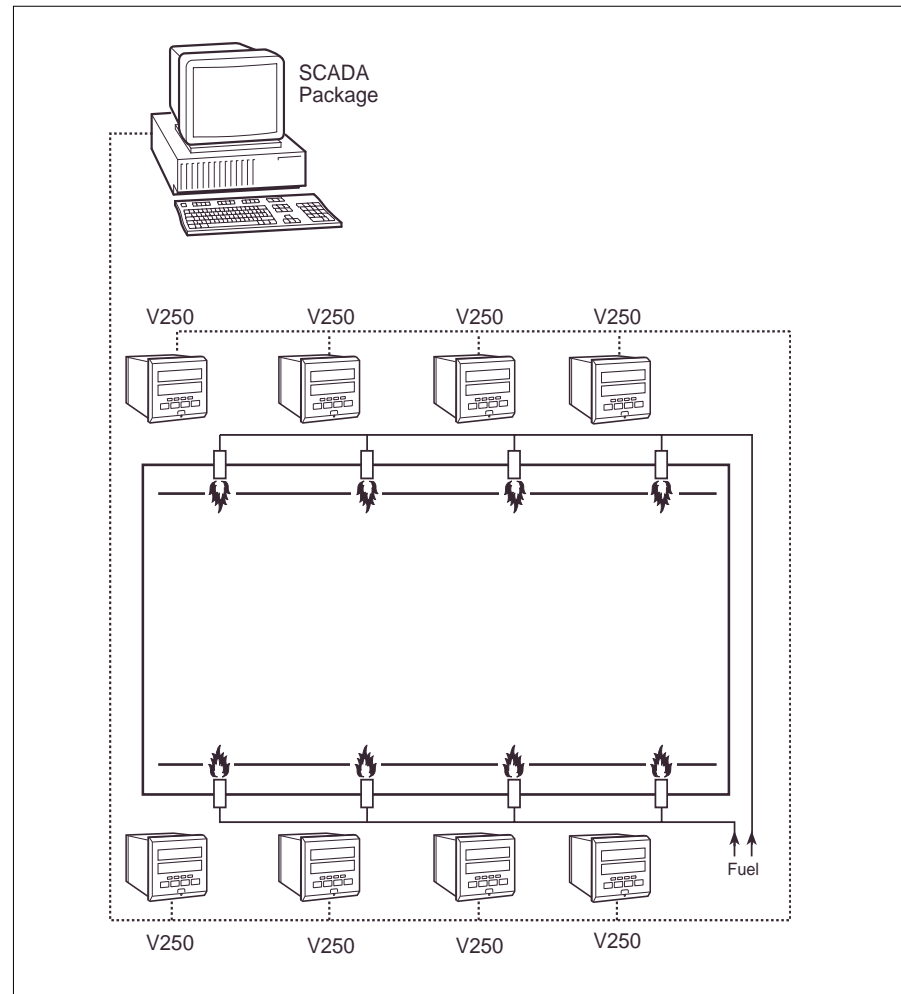
Boiler Control

▶ MOD 30ML – individual instruments can be used for different boilers and required control strategies. For simpler applications, the COMMANDER 500 can be used for level control. The MOD 30ML offers capabilities of fully-metered cross-limiting fuel/air control and parallel positioning control.

▶ All parameters such as drum level, steam flow and feedwater can be transmitted on the RS485 network to a SCADA package and provide a serial interface into the burner management system.

SCADA Package

MOD 30ML   Boiler 1

MOD 30ML   Boiler 2

MOD 30ML   Boiler 3

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AG/SER   Issue 1

ABB