SMART-CALLER BULLETIN

AVOIDING PROBLEMS WITH RS485 COMMUNICATION NETWORKS
**06/10/2011**

INTRODUCTION

We continue to be advised of problems with Annunciator display corruption and to a lesser extent 'Trouble' reports generated from within nurse-call RS485 networks. We believe that the attached technical article which describes good engineering practice will overcome the typical and significant problems being experienced. This Bulletin summarizes that article relative to common nurse-call communication problems.

The problems are particularly evident with networks carrying a number of hard-wired Annunciator displays because the symptoms are visually displayed for all to see and to complain about. It should however, be recognised that most nurse-call systems (including SmartCare-1000) also use RS485 polling networks and poor cabling techniques will therefore degrade overall performance resulting in Area Controller 'Trouble' reports being generated plus possible missed or delayed call traffic.

The cause of the problems primarily relate to the detrimental effects of unbalanced lines and/or line reflections due to Star, Branch and Stub cabling and/or the lack of a terminating resistor (typically 120Ω) at the end of line (EOL). All of the above issues will predictably cause significant reflections and consequential distortions as illustrated in the diagrams below.

It is also important to note the requirement for a 'balanced line' condition throughout the cable length. This means the mandatory use of a single twisted-pair thereby ensuring balanced high and low potentials across the two conductors throughout the cable length and therefore at each of those locations where an RS485 receiver device (i.e. an Annunciator or Area Controller) is connected.
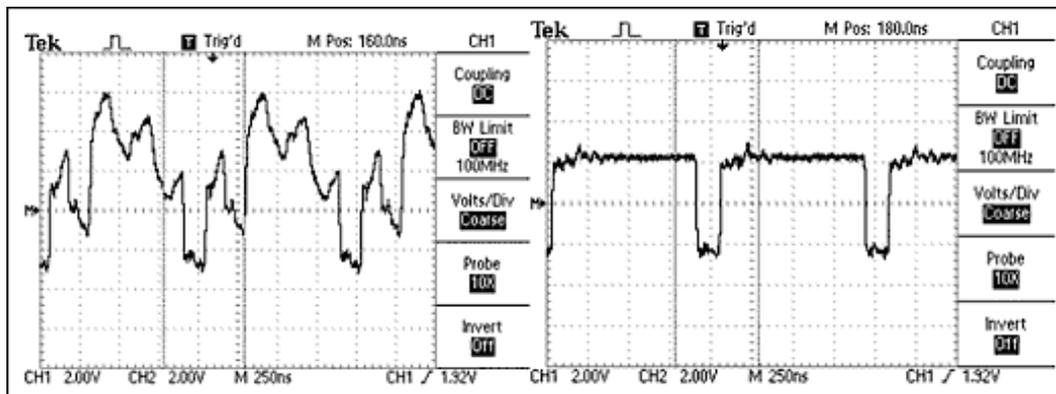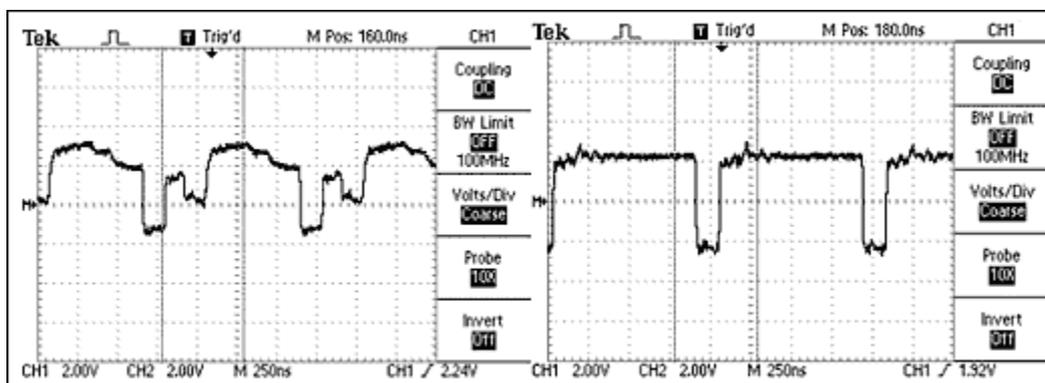

An unterminated RS-485 network and its resultant waveform (left), compared with a waveform obtained from a correctly terminated network (right).
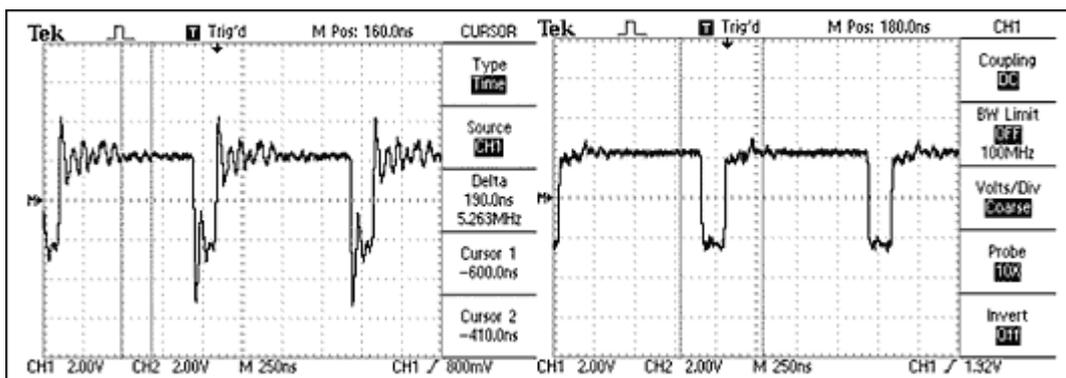
An RS-485 network that has a 10-foot stub (top) and its resultant waveform (left), compared to a waveform obtained with a short stub (right).

It is conceivable that nurse-call and Annunciator RS485 network installations may suffer the combined effects of reflections due to both unbalanced/unterminated and Star/Branch/Stub cable sections. Further, the failure to use a single twisted pair will also significantly worsen the overall situation.

The following diagram also shows the detrimental effects of placing a termination resistor at an incorrect location.


An RS-485 network with the termination resistor placed at the wrong location (top) and its resultant waveform (left), compared to a properly terminated network (right).

SUMMARY RECOMENDATIONS

(a)   Annunciator Display networks

Instead of deploying unsuitable cable runs such as Star, Branch and Stub wiring you should instead use a Star-Box-01 (illustrated) which was specifically designed to drive five isolated and balanced outputs for five separate 'Annunciator display runs'. You can also use a number of these hubs throughout the network in preference to creating branch connections because each of the hub's connections are suitably terminated internally.
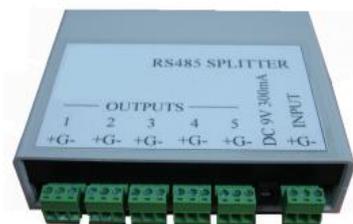
Certainly, you can 'daisy-chain' a number of the Annunciators on each line, however ensure that the last display is terminated into a 120Ω resistor. To assist in this matter we have arranged that all future supplies of displays will have a resistor and instruction note attached, however the resistor should only be applied to the last unit on each line.

(b)   Area Controllers – Nurse-call network

You cannot use the Star-Box for the Area controller network because the Star-Box is intended for one-way signalling only and not intended for both-way data. However the same cabling and termination rules apply and each Area Controller has a termination connection which must be used solely on the last unit on the line.

Again, as installers usually do not seem to carry 120Ω resistors we have arranged for our pre-sales testing department to ensure that such a resistor is supplied with each area controller along with suitable instructions.

Please refer to the attached technical article which describes these matters in more detail. It should be noted that this and similar technical articles and handbooks are available within the Agent's section of our web site www.smartcaller.com.au .