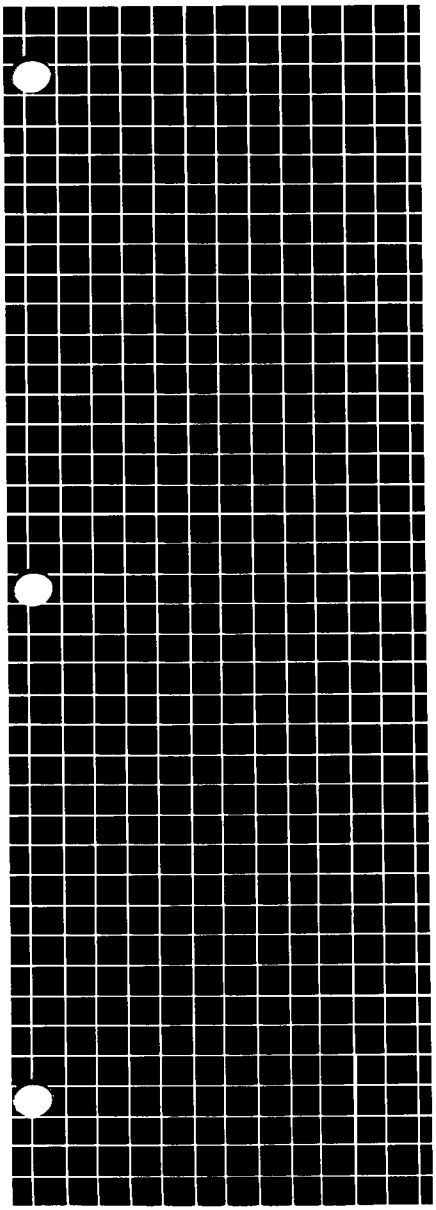

Control Room Integration of Intelligent Field Devices

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Introduction

W th n a contro room, operators are presented w th data regard ng process cond t ons and contro system status Th s nformat on used to be presented v a pane s meter and d sp ays The current trend s to rep ace the pane dev ces w th CRT d sp ays networked to d str buted process ng systems Th s perm ts the operator to nterface more nte gent y w th the process

W th the ntroduct on of the m croprocessor nto contro systems and network ng techno ogy vast amounts of process nformat on s ava ab e to the operator and other parts of the contro system Data from one process un t s ava ab e to another to opt m ze nterre at onsh ps for max mum throughput (F gure 1) The operator has access to a the process un ts v a CRT s w th s ng e po nt access v a touch screen to assure comp ete process ntegr ty

Contro rooms are not the on y part of process contro undergo ng change The techno ogy of f e d dev ces s undergo ng a s m ar evo ut on The tran s stor s g v ng way to the m croprocessor Two c asses of e ectron c f e d dev ces now ex st, one s convent ona ut z ng trans stors the other s nte gent ut z ng m croprocessors

nte gent f e d dev ces are conf gured for ca bra t on range, tag name and damp ng Conf gurat on can s gn f cant y reduce calibrat on and start up t me over convent ona dev ces Inte igent dev ces are cur rently conf gured v a a hand held conf gurator (F gure 2) that commun cates to one dev ce at a t me The conf gurator a so can request current operat ng status regard ng the sensor, e ectron cs and temperature from the f e d device for d agnostic pur poses The Inte gent f e d dev ces are more accurate and stable over amb ent temperature ranges than their convent ona counterparts

Integration Dividends

The nte gent e Smart f e d dev ce concept has been eas y adaptab e to the trad t ona measurements of temperature, pressure f ow eve and s m ar nput dev ces (F gure 3) The use of smart end actuat ng dev ces has been ess apparent and perhaps of ess perce ved va ue The ntel gent Dev ce techno ogy current y emp oyed ut zes a stand a one sensor (usua y ana og by nature) n conjunct on with the onboard m croprocessor to hand e the s gna con d t on ng, requ red env ronmenta compensat ons, and s gna generat on The m cro w hand e b d rect ona commun cat ons w th other dev ces where requ red Dur ng the 1980's the domest c ndustr a controls market has been character zed by p ant modern za t ons rather than new greenf e d nsta at ons Therefore current vendor des gns have tended to ut ze the w de y accepted analog 4 to 20 mA s gna to transm t the measured or computed var ab e to an ex st ng contro and c ata co ect on system

There are many rea benef ts ava ab e ut z ng th s techno ogy eve From the users perspect ve the tang b e benef ts may be an mproved measurement a ow ng IMPROVED PROCESS CONTROL and ead ng to more throughput v a more prec se b end ng, mproved combust on contro or accurate custody transfer

W th th s mproved measurement performance comes a new eve of DEVICE FLEX B L TY The n t a smart f e d dev ces were promoted as a more un versa dev ce for that measurement Pressure and f ow measurement p oducts had ncreased range ab ty wh e ma nta n ng exce ent stab ty when pro per y ' compensated ' for env ronmenta dr ft factors such as temperature Th s rangeab l ty m ght reduce the end users nventory of d fferent range un ts

Smart temperature transm tter offers an exce ent examp e of th s f ex b ty n most cases the sensor type and range can be f e d programmed nto the dev ce us ng the propr etary Commun cator S nce a smart temperature transm tters become dent ca nventory and ma ntenance act v t es are ess and n herent y more cost effect ve A fu ne supp er of smart dev ces can now bu d common e ectron cs for severa dev ces and mere y conf gure the e ectron cs to match the dev ce Th s approach s ut zed by Ba ey throughout the r pressure f ow eve temperat re and pH f e d dev ces

mproved process contro enç neer ng sav ngs p us reduced ma ntenance and nventory expenses have he ped estab sh the v ab ty of the smart f e d devices The marriage between the smart devices and contro system w pay add t ona d v dends beyond those ment oned Ba ey now has NF 90 hardware and software to a ow on ne d g ta commun cat ons to ts fu ne of smart f e d dev ces Low cost BM AT or XT compat b e term na s are emp oyed to free up the NF 90 conso es from th s smart dev ce management funct on

SmartPort™ software br ngs th s rea t me management capab ty for smart dev ces nto one ow cost term na Beyond the benef ts nherent w th a s ng e smart dev ce th s on ne w ndow a ows the user to perform severa new funct ons The most ob v ous s the CONT NUOUS D AGNOST C CHECK on the smart dev ces hea th By except on report ng dev ces nd cat ng a d agnost c hardware prob em w be brought to the operator s attent on Hardware pro b ems can be d st ngu shed from process a arms and f des rab e the smart dev ce output may automat c a y be dr ven or he d to a des rab e eve

Respann ng a smart transm tte from the centra control station has been an ever present request from users Chang ng process or seasona demands for product have made th s part cu ar y usefu Ba ey s SmartPort perm ts any transm tter to be addressed by ts Tag Number dent f cat on The operator may then change any transm tter spec f cat on by mere y typ ng the des red va ues on the computer term na and n t ate the down oad to that dev ce S nce the SmartPort may store many conf gurat ons for the same transm tter, a ser es of batch ng conf gurat ons m ght be estab shed By se ect ng the batch ng f e wh ch has the des red smart transm tter conf gura t ons one w shes to change the operator may redef ne those transm tters to the des red conf gurat on Of course these transm tters can a be conf gured from the computer dur ng nsta at on a substant a t me sav ngs p us a guarantee a are set as des gned F e d mod f cat ons by author zed or unauthor zed person ne w be detected and annunc ated

By expand ng the def n t on of batch ng to nc ude a startup or shutdown rout ne, smart transm tters may be ass gned tempora y conf gurat ons to fac tate e ther of these act v t es

The ab ty to adjust smart transm tters from the contro room s now pract ca The mproved contro reduced engineering effort and lower inventory con t nue to be pr me benef ts of smart transm tters Transm tter secur ty, batch process ng and process f ex b ty are benef ts now poss b e but yet not w de y mp emented

Currrent Implementations

Contro system manufacturers current y prov d ng centra zed transm tter commun cat ons a have pro pr etary hardware to nterpret the commun cat on s gna f the commun cat on protoco does not a ow for s mu taneous transm ss on of process var ab e (PV) and commun cat on, a regenerated process var ab e s gna may be requ red at that commun ca t on nk Th s approach wou d make the contro system dependent on th s s gna generator

Severa vendors (nc ud ng Ba ey) prov de for s mu taneous PV s gna (4 to 20 mA) and commun ca t ons W th Ba ey s nput hardware th s approach pro v des the user w th severa eve s of PV secur ty Ba ey s NF 90 has two sty es of commun cat on modules to facil tate transmitter commun cat on wh e br ng ng the PV s gna n for contro and data co ect on For h gh vo ume performance mon tor ng or those app cat ons where secur ty s not of pr me mportance an nexpens ve ana og s ave modu e w a ow 15 smart dev ces to commun cate w th the operator conso e Where contro secur ty s pr me a contro nput/output s ave hand ng four PV nputs and two contro outputs may be emp oyed S nce a rea t me PV s gna s a ways ava ab e some add t ona eve of redundancy s a ways ava ab e

Once the commun cat on s gna s ava ab e to the system the need to hand e nformat on along the system's data h ghway s obv ous Ba ey s approach al ows for process ng of the commun cat on through the NF 90 Power Mu t Funct ona Processors (MFP) The MFP hand es contro and commun cat on func t ons so smart dev ce commun cat ons can be pass ed down Ba ey's p ant oop to the centra zed oca t on Therefore standard NF 90 remote nput capab ty provides the abi ty to commun cate w th smart transm tters throughout a wide y d str buted n sta at on The need for spec a and cost y com mun cat on hardware s e m nated

W th the commun cat on s gna nformation on Ba ey s NF NET the user may now e ect to d rect *the nformat on to* NFI 90 s Operator nterface Sta t on (O S) or advanced Management Command System (MCS) operator contro s Transm tter con f gurat on may be rev ewed or a tered n Ba ley's trad t ona b ock address and funct on code format

Many users f nd a cost effect ve persona com p..ter (PC) or Ba ey s Eng neer ng Work Stat on as the most des rab e smart transm tter management nter face Ut z ng Ba ey s propr etary SmartPort soft ware, the operator can eas y monitor and mod fy con f gurat ons of the smart transmitters (F gure 4)

The PC nterface offers both techn ca and econom c va ues SmartPort runs under the standard DOS 3 0 operat ng system and requ res no propr etary computer equ pment A Commerc al y ava ab e BM AT s a *that s requ red Specia zed computer* sk ls or ma ntenance act v ty are not requ red

The PC based program SmartPort requ res no prior know edge of the INF 90 system The smart transm t ter tag l st ngs and conf gurat ons are oaded nto a PC f e and SmartPort w automat cal y translate the user fr end y ' transmitter temp ates nto NF 90 protoco and pass requ red nformat on to the transm tters The rea t me diagnost c mon tor ng act v ty w cont nue through th s ow cost termina

Once an ndustry standard commun cat on pro toco s estab shed, f e d dev ces from many vendors w undoubted y be addressab e through systems ke NF 90 (F gure 5) Most ke y, standard zed PC based term na s w cont nue to prov de the w ndow *to most effect ve y dea w th the smart f e d devices* The hardware between transm tter and PC w undoubted y cont nue to be propr etary and system spec fic

Future

Dur ng the ast decade, techno ogy advances have had a profound effect upon the Instrumentat on and Contro s ndustry Th s can be seen n the evo ut on of the contro room as we as the f e d dev ces so cr t ca *to the measurement needs The future pro* m ses to be even more dramat c w th respect to techno ogy re ated changes n the &C ndustry and n part cu ar to the ntegrat on of the contro room and nte gent f e d dev ces

A key factor n th s chang ng p cture s a need for a standard for d g ta f e d commun cat ons and n tegrat on nto a tota d g ta control system Th s stan dard zat on s a cr t ca tem for the users of nte l gent f eld dev ces *Current* y, several standards organ za t ons are work ng to def ne a universa commun ca t ons approach There are severa obstac es wh ch must be overcome befo e acceptance by the ndustry F rst, and maybe foremost, s the ssue of re ab ty Whatever standard is agreed upon t must be more rel ab e than the current 4 20 mA system w th respect to error free operat on and rugged zat on *t needs to* be ow cost and prov de stab e oop dynam cs for eff c ent and accurate contro F na y, t must be an ndustry w de, wor d w de accepted standard to be effect ve

Advantages of such a standard nc ude reduct on n w r ng cost, data val d ty reduced ma ntenance mproved accuracy and near zat on and s mp f ed nsta at on and comm ss on ng

Another area wh ch w see tremendous advances s the nte gent f e d dev ce Tru y d g ta dev ces w become the norm The current ana og sens ng systems w be rep aced by d g ta sens ng techno og es Th s w prov de for more accurate measurement of the selected parameters as we as reduc ng the cost of the f e d dev ce Ana yt ca measurements once too expens ve and t me consum ng for true on l ne rea t me contro w become com mon and w de y accepted n the controls ndustry

The power of the m croprocessor w resu t n nte gent f e d dev ces prov d ng oca contro as we as the measurement Th s oca s ng e oop contro w comp ement the d str buted d g tal contro strategy but s mp fy the hardware requ red to accomp sh th s task n add t on the reduct on of power consumpt on requ red by the processor and sens ng e ement w result n se f powered un ts by us ng so ar arrays or harness ng the energy (heat) f ow

between the process a ıd the amb ent env ronment Th s cou d ead to a w re ess transm tter for remote use

F na y, the man mach ne nterface for a tota y ntegrated system w see dramat c advances n the years to come Touch screen CRTs are becom ng commonp ace n today's contro room and w be the norm for nte gent f e d dev ces n a types of env ronments Th s m grat on w prov de for mproved user nteract on w th the dev ce and the con tro system Reduce ma ntenance and troub eshoot ng w be major benef ts

The techno ogy w th the most potent a for a major breakthrough n the &C ndustry s art f c a nte gence or expert systems Or ce th s has been mp emented nto the contro room t w evo ve nto a phases of the total contro system Expert systems w prov de for more cons stent contro of cr t ca pro cesses while reducing the overall cost assoc ated w th the contro process

Conclusion

The ntegrat on of nte gent f e d dev ces to distr buted contro system has begun Th s ntegra t on prov des new too s and approaches for so v ng measurement and contro prob ems n process app cat ons The ntegrated system prov des the des gners and operators the opportun ty to pursue new contro system strateg es wh ch w produce econom c benef ts to the end user

There are techn ca and funct ona obstac es wh ch must be overcome before the opt mum tru y ntegrated system becomes a rea ty As the techn ca barr ers are overcome port ons of the system w be mp emented n the ndustry Ba ey Contro s s ded cated to prov d ng the most cost effect ve con tro system to ts customers and the deve opment and ntegrat on of nte gent f e d dev ces s a major effort n ts overa bus ness strategy

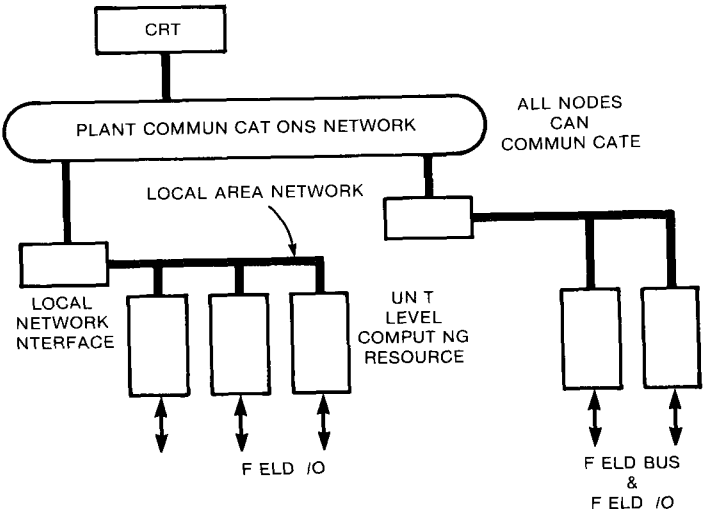

FIGURE 1 System Architecture

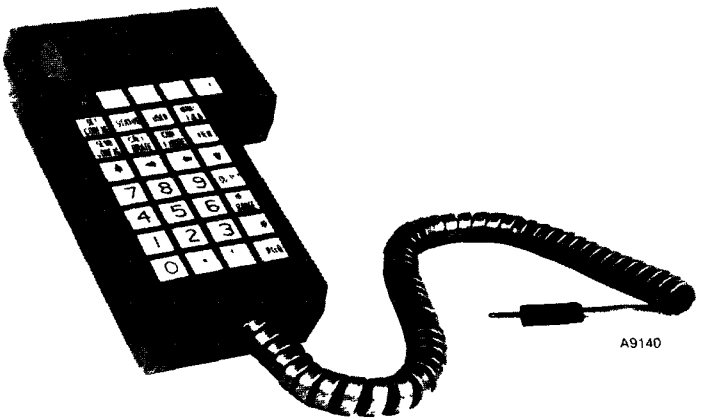

FIGURE 2 Type STT01 Smart Transmitter Terminal

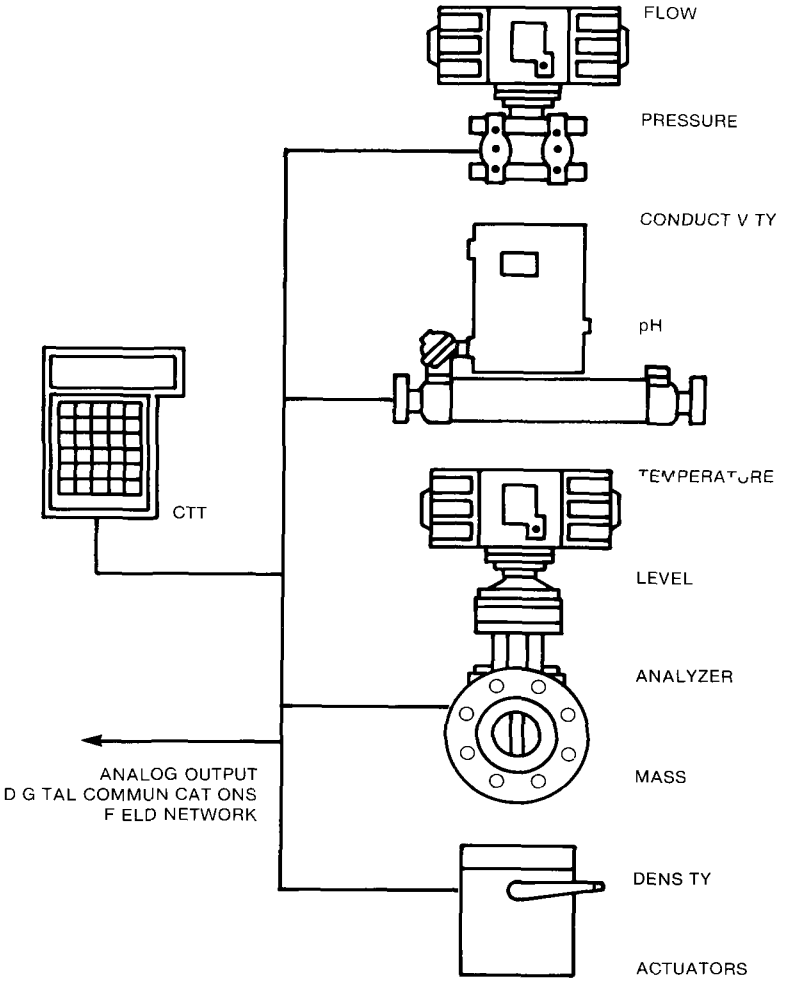

FIGURE 3 Smart Field Devices

```
ENVIR  MONITOR/TUNE DATABASE:SYSTEM1

  ID Tag              :  LT 239          Service      : TANK 239 LEVEL
  Device type         :  SMART BC        Mfr's part no.    : BC24-15-5
                                         Manufacturer name : BAILEY CONTROLS
  Eng  Units          :  INCH            Device location:
  Upper Range Limit:     200.00               PCU address:   1
  Lower Range Value:       0.00               MFC address:   3
  Upper Range Value:     150.00               ASI address:   5
  Span                :  150.00               Channel No.:   6

  Dampering (sec)     :    2.00 SEC      Date Commissioned : 9/13/87
                                         Commissioned by   : J. SMITH
  Output Mode         :  LINEAR          Date last Modified: 9/13/87
  Norm/Rev Acting     :  NORMAL          Modified by       : L. JONES
  Initialize Mode     :  HIGH
  Fail Mode           :  LOW                   OUTPUT:   37.56  INCH
                                               QUALITY:  GOOD
  Comments:  LEVEL OF TANK 239

            TO ABORT PRESS Esc       NEXT DEVICE = PgUp
            TO DELETE PRESS End      PREVIOUS DEVICE = PgDn
```

FIGURE 4 Sample Configuration

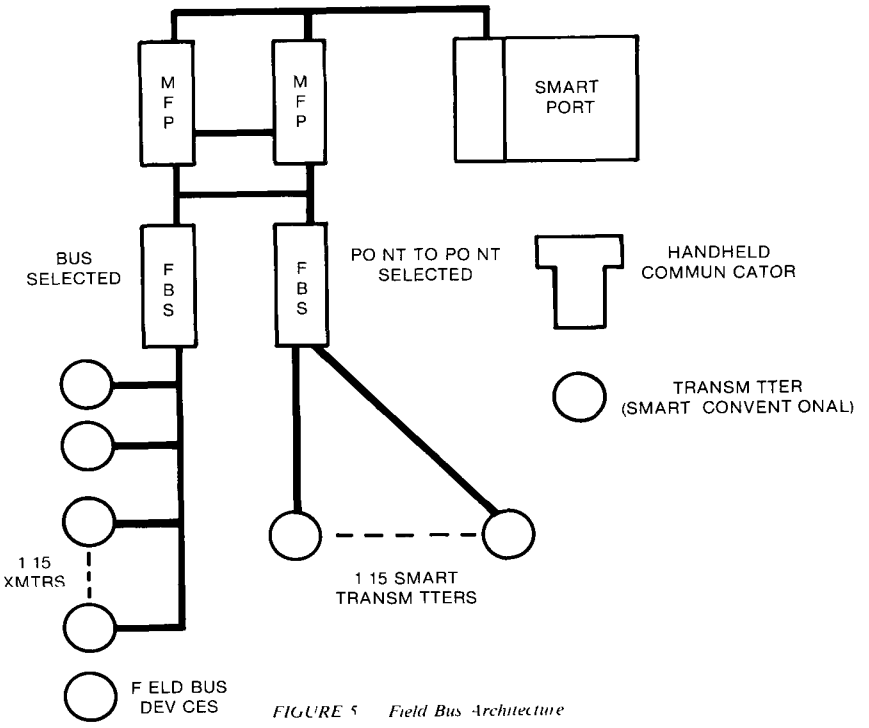

FIGURE 5 Field Bus Architecture

Bailey Controls

Babcock & Wilcox, a McDermott company

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