The Measure is the unit of information in the *Energy Efficiency Manual*. Each Measure is a self-contained, hands-on guide to one specific method of saving energy and reducing utility costs.

the **Measure number** locates this Measure within the 400 Measures of the *Manual.*

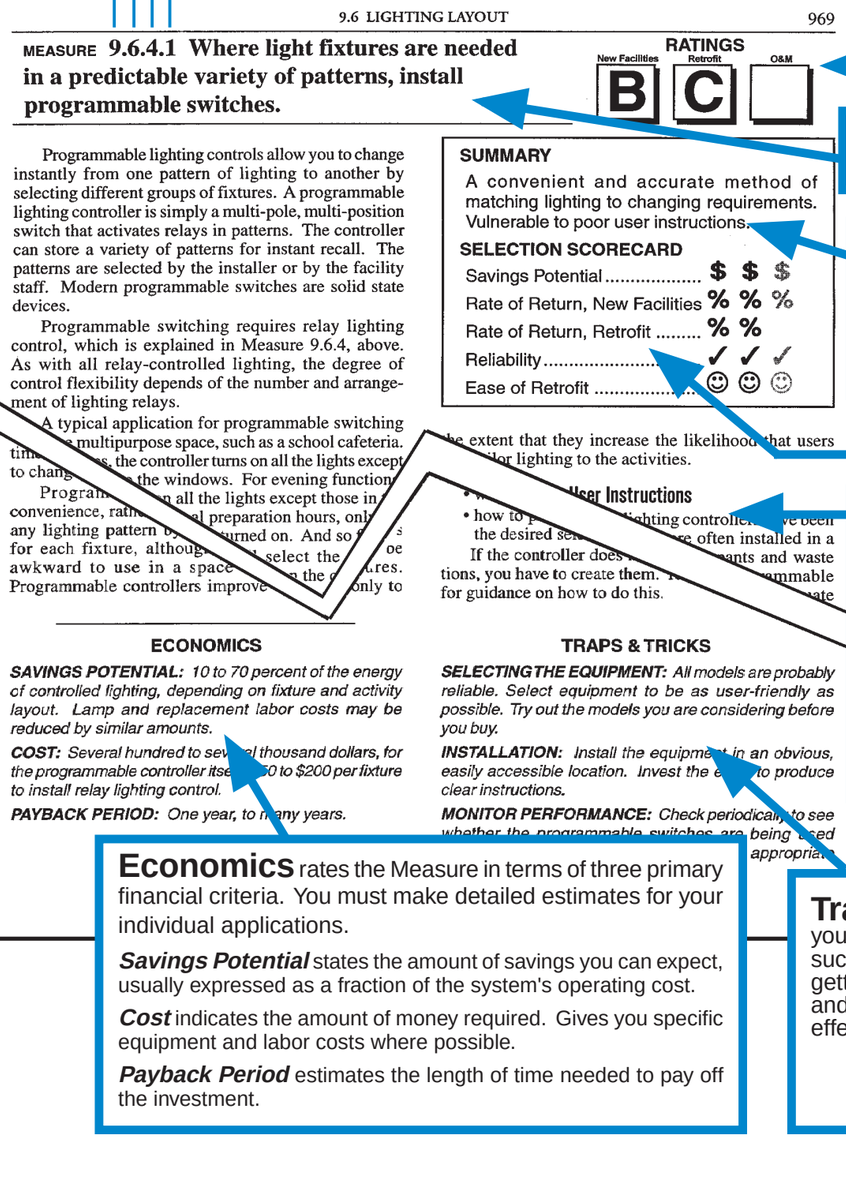
the ***Section*** tells you the major subject area, such as boilers, water systems, or lighting.

the ***Subsection*** tells you the specific type of energy system, such as boiler fuel systems. Or, it tells you a specific area of efficiency, such as reducing solar cooling load.

the ***sequence number*** within the Subsection. The Measures are grouped logically.

the ***subsidiary sequence number***. Only "subsidiary" Measures have this.

NOTE: In the text, **"ff"** after a Measure number means "*the Measure and every Measure that is subsidiary to it.*"



9.6 LIGHTING LAYOUT 969

MEASURE 9.6.4.1 Where light fixtures are needed in a predictable variety of patterns, install programmable switches.

RATINGS — New Facilities: B; Retrofit: C; O&M:

Programmable lighting controls allow you to change instantly from one pattern of lighting to another by selecting different groups of fixtures. A programmable lighting controller is simply a multi-pole, multi-position switch that activates relays in patterns. The controller can store a variety of patterns for instant recall. The patterns are selected by the installer or by the facility staff. Modern programmable switches are solid state devices.

Programmable switching requires relay lighting control, which is explained in Measure 9.6.4, above. As with all relay-controlled lighting, the degree of control flexibility depends of the number and arrangement of lighting relays.

A typical application for programmable switching is a multipurpose space, such as a school cafeteria. ... the controller turns on all the lights except ... to chang... the windows. For evening function... Progra... all the lights except those in ... convenience, rat... al preparation hours, onl... any lighting pattern b... urned on. And so ... for each fixture, althoug... select the ... awkward to use in a space ... the ... ures. Programmable controllers improve ... only to ...

SUMMARY

A convenient and accurate method of matching lighting to changing requirements. Vulnerable to poor user instructions.

SELECTION SCORECARD

Savings Potential	$ $ $
Rate of Return, New Facilities	% % %
Rate of Return, Retrofit	% %
Reliability	✓ ✓ ✓
Ease of Retrofit	☺ ☺ ☺

...he extent that they increase the likelihood that users ...lor lighting to the activities.

...User Instructions

- ... how to p... lighting controller... ve been the desired sen... re often installed in a

If the controller does ... ants and waste tions, you have to create them. ... mmable for guidance on how to do this. ...ate

ECONOMICS

SAVINGS POTENTIAL: *10 to 70 percent of the energy of controlled lighting, depending on fixture and activity layout. Lamp and replacement labor costs may be reduced by similar amounts.*

COST: *Several hundred to sev... thousand dollars, for the programmable controller itse... 50 to $200 per fixture to install relay lighting control.*

PAYBACK PERIOD: *One year, to m... any years.*

TRAPS & TRICKS

SELECTING THE EQUIPMENT: *All models are probably reliable. Select equipment to be as user-friendly as possible. Try out the models you are considering before you buy.*

INSTALLATION: *Install the equipment in an obvious, easily accessible location. Invest the e... to produce clear instructions.*

MONITOR PERFORMANCE: *Check periodically to see whether the programmable switches are being used appropria...*

the **Measure title** says what to do.

the **Summary** highlights aspects of the Measure that place it in perspective within your overall efficiency program.

the **text** of the Measure explains ***who, what, where, when, how,*** and ***why***. It focuses on issues that are directly related to accomplishing the Measure. (Important background information for the Measures is in the **Reference Notes**, Section 11.)

Economics rates the Measure in terms of three primary financial criteria. You must make detailed estimates for your individual applications.

Savings Potential states the amount of savings you can expect, usually expressed as a fraction of the system's operating cost.

Cost indicates the amount of money required. Gives you specific equipment and labor costs where possible.

Payback Period estimates the length of time needed to pay off the investment.

Traps & Tricks alert you to factors that threaten success. Gives you hints for getting it right the first time and for keeping the Measure effective in the long term.

the **Ratings** suggest the priority that this Measure deserves in your overall energy conservation program, in typical situations.

*for **New Facilities**:*

- **A** Do it wherever it applies. It costs little, and it has no significant disadvantages.
- **B** Do it in most cases. Modest cost. Pays back quickly. Does not need special skill or increased staffing.
- **C** It is very expensive. Or, the payback period is relatively long. Or, operation may require substantial effort, special skill, or continuing management attention.
- **D** It provides only a small benefit in relation to its cost. Or, it may have high risk because it is novel, unreliable, difficult to install, or difficult to maintain.

*for **Retrofit**:*

- **A** Do it wherever it applies. Simple and quick. Costs little in comparison with its benefits. The risks can be managed easily by the present staff.
- **B** Do it in most facilities where it applies. Pays back quickly. Easy to accomplish. Requires a modest amount of money, effort, and/or training. May have pitfalls that require special attention.
- **C** Expensive or difficult. Or, the saving is small in relation to the money, effort, skill, or management attention required. The risks are clear and manageable.
- **D** Expensive, and provides only little benefit. Or, exceptionally risky because it is difficult to accomplish correctly, or difficult to maintain, or unproven, or unpredictable.

*for **Operation & Maintenance**:*

- **A** Simple, quick, and foolproof. Or, it must be done to prevent damage or major efficiency loss.
- **B** Will be done in a well-managed facility. Pays back quickly. Fairly easy to accomplish. Not too risky. Requires a modest amount of money, effort, and/or training. Or, it is a less critical maintenance activity.
- **C** Requires substantial money, effort, special skill, and/or management attention. Or, the benefit is small.
- **D** The benefit is small in relation to cost. Or, it is exceptionally difficult to accomplish. Or, it has potential for serious adverse side effects.

the **Selection Scorecard** rates the financial and human factors that are most important for deciding whether to exploit the Measure in your application. The scores are for typical commercial applications. *Shaded symbols indicate a range of scores.*

Savings Potential is expressed as a percentage of the facility's total utility cost.

$ $ $ $	over 5%
$ $ $	0.5% to 5%
$ $	0.1% to 0.5%
$	less than 0.1%

Rate of Return estimates the percent of the initial cost that is saved each year.

% % % %	over 100%
% % %	30% to 100%
% %	10% to 30%
%	less than 10%

Reliability indicates the likelihood that the Measure will remain effective throughout its promised service life.

- ✓ ✓ ✓ ✓ **FOOLPROOF**. Equipment or materials will last as long as the facility. Maintenance requirements will not cause the Measure to be abandoned. If a procedure, it is easy to administer. Or, it is a simple, one-time effort.
- ✓ ✓ ✓ **RELIABLE**. Equipment has long service life, is not very vulnerable to damage, negligence, or poor operating practice. May fail visibly at long intervals. If a procedure, it is fairly easy to maintain and requires only modest skill.
- ✓ ✓ **FAILURE PRONE**. Equipment needs skilled maintenance, or it is vulnerable to damage or poor operating practice. Fails invisibly. If a procedure, it is easily forgotten or requires continuing supervision.
- ✓ **VERY RISKY**. Equipment has poor or unknown reliability. Or, it needs frequent maintenance. If a procedure, it is difficult to learn or it may easily cause damage.

Ease of Retrofit or ***Ease of Initiation*** indicates how easy it is for the people involved to accomplish the Measure properly.

- ☺ ☺ ☺ ☺ **EASY**. Only minimal effort and no extra skill are required. No tricky factors.
- ☺ ☺ ☺ **ROUTINE**. Not much effort or skill required. May need to learn a new procedure.
- ☺ ☺ **DIFFICULT**. Needs major staff effort. Or, hard to find reliable contractors. May be tricky.
- ☺ **VERY CHALLENGING.** Can be unpleasant, likely to be resisted. Or, installation is difficult and expensive. Or, requires major experimentation.